A737 Improvements at Beith

Environmental Statement

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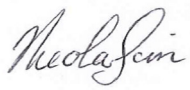
Final	Name: Stephannie Coomber, Malcolm Bryson, Lorna McCrae, Tracey Smith Signatures:  Date: 14/10/2016	Name: Nicola Sim Signature:  Date: 14/10/2016	Name: Jennifer Craig Signature:  Date: 24/10/2016

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Glossary

Abbreviation	Term
3D	3 Dimensional
AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekday Traffic
AD	Anno Domini
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
AQS	Air Quality Standard
BCHS	Beith Cultural Heritage Society
BCR	Benefit Cost Ratio
BGS	British Geological Society
BS	British Standard
CEMP	Construction Environmental Management Plan
CRTN	Calculation of Road Traffic Noise
DAL	Differential Acceleration Lane
DM	Do-Minimum
DMRB	Design Manual for Roads and Bridges
DS	Do-Something
EIA	Environmental Impact Assessment
ES	Environmental Statement
FoS	Friends of Spiers
HA	Highways Agency
HDV	Heavy Duty Vehicle
HERs	Historic Environmental Records
HES	Historic Environment Scotland
HGV	Heavy Goods Vehicles

Abbreviation	Term
HLA	Historic Landscape Assessment
Hz	Hertz
IAN	Interim Advice Note
IAQM	Institute of Air Quality Management
IT	Interim Target
LAQM TG	Local Air Quality Management Technical Guidance
LDP	Local Development Plan
LDV	Light Duty Vehicle
LTT	Long-Term Trend
MAGIC	Multi Agency Geographic Information for the Countryside
MMP	Materials Management Plan
MoU	Measure of Uncertainty
NAC	North Ayrshire Council
NAEI	National Atmospheric Emissions Inventory
NISR	Noise Insulations (Scotland) Regulations
NHBC	National House Building Council
NMRS	National Monument Record of Scotland
NMU	Non-Motorised User
NNG	Night Noise Guidelines
NO_2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
NSR	Noise Sensitive Receptor
NTS	Non-Technical Summary
OS	Ordnance Survey
PAN	Planning Advice Note
PM_{10}	Particulate Matter

Abbreviation	Term
PPG	Pollution Prevention Guideline
RCAHMS	Royal Commission on the Ancient and Historical Monuments of Scotland
S2	Two-Lane Single Carriageway
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SEPA	Scottish Environment Protection Agency
SHEP	Scottish Historic Environment Policy
SPP	Scottish Planning Policy
SPA	Special Protection Area
SRP	Soil Resource Plan
SSSI	Site of Special Scientific Interest
STAG	Scottish Transport Appraisal Guidance
SuDS	Sustainable Urban Drainage System
SWMP	Site Waste Management Plan
TRL	Transport Research Laboratory
WHO	World Health Organisation
WoSAS	West of Scotland Archaeology Service

1 Introduction

1.1 Need for the project

1.1.1 The A737 was constructed in 1933 and became a trunk road in 1996. The A737 at Beith is now sub-standard in terms of width, alignment and visibility when compared to current design standards for new roads. It typically carries 14,000 vehicles per day.

1.1.2 Problems with the A737 at Beith include:

- Poor accessibility to and from the side roads at the junctions with the B777 Head Street / Wardrop Street and the B706 Barrmill Road / Geilsland Road
- Road safety at these junctions
- Insufficient provision for pedestrians and cyclists and a lack of safer places cross the A737.

1.1.3 The section of the A737 under consideration is shown in Drawing 25000199-WP10-000-001 Layout1, and incorporates two priority junction arrangements; a crossroads at B777 Head Street/Wardrop Street and an unconventional staggered junction arrangement at B706 Barrmill Road/Geilsland Road. The junctions have a poor safety record and cause regular near misses. Drivers and non-motorised users experience difficulty joining or crossing the trunk road at the junctions.

1.2 Need for environmental impact assessment (EIA)

1.2.1 The formal requirement for an EIA is determined by the Environmental Impact Assessment (Scotland) Regulations 1999 as amended by the Environmental Impact Assessment (Scotland) Amendment Regulations 2006. These Regulations implement European Commission Directive 85/337/EEC as amended by Directive 97/11/EC, and require an EIA to be undertaken on the effects of certain public and private projects on the environment. The requirement for EIA of trunk road projects is set out in the Roads (Scotland) Act 1984 (c.54, Sections 20A and 55A) as amended by Part III of the Environmental Impact Assessment (Scotland) Regulations 1999 and The Environmental Impact Assessment (Scotland) Amendment Regulations 2006 hereafter referred to as the EIA Regulations.

1.2.2 Projects are described by type within the EIA Directive. Those of a type listed in Annex I of the EIA directive must be subject to a mandatory EIA. For projects listed in Annex II,

EIA is not mandatory and each project must be reviewed on a case-by-case basis against certain thresholds or where it is located in a sensitive area. If it is considered that the project is an Annex II project, then it should be screened against the criteria set out in Annex III to determine if an EIA is required.

1.2.3 The A737 Improvements at Beith scheme as a trunk road project is promoted under the Roads (Scotland) Act 1984 and is considered to be an Annex II project. A screening determination was therefore required on the need for an EIA.

1.3 Purpose and content of the Environmental Statement

1.3.1 The purpose of an Environmental Statement (ES) is to ensure that the environmental effects of a proposed development are fully considered, together with the economic or social benefits of the development before a decision is made to provide consent to the development. The purpose of this ES is to investigate the likely effect of the proposed scheme on the environment and local communities, to describe environmental constraints and propose mitigation.

1.3.2 This ES will provide supporting information with the publication of statutory draft orders and fulfils the Scottish Ministers' determination that the scheme should be the subject of an EIA. The Statutory Draft Orders will consist of the Road Order, De-trunking Order and Compulsory Purchase Order. The methods used in the preparation of this ES follow those set out in guidance published within the Design Manual for Roads and Bridges (DMRB) Volume 11 'Environmental Assessment'. The basic requirements of an ES are outlined in the DMRB Volume 11 Section 2, Part 2 (HA 202/08) (Ref 1.1) and set out as a mandatory requirement in the DMRB Volume 11 Section 2 Part 6 (HD 48/08) (Ref 1.2) paragraphs 3.2 to 3.4, as follows:

"An ES is the document that should contain information meeting the requirements of the EIA Directive as translated into UK law by the EIA Regulations. The ES will identify, describe and assess in an appropriate manner, in the light of each individual case and in accordance with Articles 4 to 11 of the Directive and the EIA Regulations, the significant environmental effects of the project on the factors mentioned in Article 3 of the EIA Directive. It will contain the information referred to in the EIA Regulations and Annex IV of the EIA Directive to the extent that the Secretary of State or equivalent considers that it is relevant to the specific characteristics of the project and of the environmental features likely to be affected by it; and that (having regard in particular to current knowledge and methods of assessment) the information may reasonably be gathered."

1.3.3 In line with the regulations, an ES should contain the following:

- a description of the project (in accordance with the relevant EIA Regulations)
- a description of the measures envisaged in order to avoid, reduce and, if possible, remedy significant adverse environmental effects
- the data required to identify and assess the main effects which the project is likely to have on the environment
- an outline of the main alternatives studied and an indication of the main reasons for the choice of project, taking into account the environmental effects
- a non-technical summary of the information mentioned in paragraphs above.

1.3.4 An ES generally comprises two parts, with different levels of detail and complexity. Firstly, the statement which is a comprehensive document drawing together all the relevant information about the environmental impacts of the project. Secondly, a Non-Technical Summary (NTS) which is a brief report summarising the principal sections of the statement in non-technical language to be readily understandable by members of the public. The NTS is included with the statement, but is also available as a freestanding document.

1.3.5 These chapters included in this ES are:

- Chapter 1 Introduction which provides the purpose of the report
- Chapter 2 The Project and Alternatives Considered which describes the scheme and relevant background information along with descriptions of the alternative options considered during previous stages
- Chapter 3 Construction, Operation and Maintenance which describes the construction methods and details post construction operation and maintenance actions
- Chapter 4 Environmental Impact Assessment Process and Method which describes the approach to this assessment and explains how impact significance is determined
- Chapter 5 Consultation which describes the consultation process undertaken, with statutory and non-statutory bodies, as part of the Environmental Impact Assessment process. Details on the methods used to collect information from the consulted are provided, together with an indication of their views

- Chapters 6 to 16 Technical Chapters which describe the baseline conditions, likely impacts, mitigations measures, residual impacts, limitations and conclusions. The topics described are:
  - Air Quality
  - Cultural Heritage
  - Landscape and Visual Effects
  - Ecology and Nature Conservation
  - Geology and Soils
  - Materials
  - Noise and Vibration
  - Effects on all Travellers
  - Community and Private Assets
  - Road Drainage and the Water Environment
  - Interactions and Cumulative Impacts
- Chapter 17 Schedule of Environmental Commitments provides a summary of the mitigation measures and monitoring requirements that will be required by the scheme
- Chapter 18 Summary and Conclusions presents a summary of the permanent environmental impacts that are likely to arise from the scheme along with concluding comments.

1.3.6 Each of the technical impact assessment chapters describes the characteristics of the existing environment (the baseline environment), identifies the elements which would be the most sensitive to loss or disturbance, and assesses the range and intensity of potential impacts that are predicted from the scheme. Based on this assessment, the types of management and mitigation which need to be put in place to reduce any significant impacts are explained and the significance of any residual impact is described.

1.4 Review and comments

1.4.1 This ES has been prepared on behalf of Transport Scotland, to assess the potential environmental impacts of the A737 Improvements at Beith scheme.

1.4.2 Following the follow publication of the Draft Statutory Orders and ES, a public consultation period of six weeks from the advertised date of publication for comments or representations to be made to Transport Scotland on the scheme and its environmental impacts.

1.4.3 Copies of this Environmental Statement and Non-Technical Summary will be available for inspection during normal office hours at the following location:

Transport Scotland

Buchanan House

58 Port Dundas Road

Glasgow G4 0HF

1.4.4 Any comments on the scheme should be addressed in writing to the Chief Road Engineer at the above address before the closing date for comments and objections given in the public notice.

2 The Project and Alternatives Considered

2.1 Background to the project

2.1.1 The trunk road authority has commissioned four primary improvement schemes on the A737 at Beith since it became a trunk road in 1996. A carriageway improvement at the north end of the Beith Bypass was designed by North Ayrshire Council and constructed in 2002. The remaining three schemes for junction improvements at the B777 Head Street / Wardrop Street crossroad, junction improvements at the B706 Barrmill Road staggered junction and a carriageway widening at the south end of the Beith Bypass were commissioned individually and developed to different states of readiness by 2013 but none of them progressed to construction.

2.1.2 Transport Scotland decided to undertake a strategic review of the three schemes, including the previous work that had been undertaken, to ensure that the optimal solution is identified for the A737 at Beith. The strategic review has led to the development of the Improvements at Beith scheme, thereafter referred to as the scheme.

2.1.3 As discussed in Section 1.3.1, the main issues with the current A737 at Beith include poor road safety and accessibility to and from the side roads at the junctions with the B777 Head Street / Wardrop Street and the B706 Barrmill Road / Geilsland Road and insufficient provision for pedestrians and cyclists including a lack of safer places cross the A737. To address these issues the main objectives of the scheme are to:

- Improve the operational performance and level of service and safety on the A737 by reducing the effects of driver stress and journey times
- Improve journey time reliability
- Maintain the asset value of the A737
- Ensure that facilities are fully compliant with the requirements of the Disability Discrimination Act 2005 (Ref 2.1) through application of Transport Scotland's "Roads for All" guidance as amended or updated (Ref 2.2)
- Achieve good value for money for both taxpayers and transport users
- Develop engineering solutions for the proposed infrastructure in line with the requirements of the DMRB

- Improve sustainability in design and construction.

2.2 Alternative design options considered

2.2.1 The requirement to consider alternatives is integral to the requirements of the EIA Regulations. Schedule 4 of the Regulations identifies the information for inclusion in Environmental Statements. Parts 1 (2) and 2 (4) include:

"An outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for the choice made, taking into account the environmental effect".

2.2.2 This is reiterated within Planning Advice Note (PAN) 1/2013: Environmental Impact Assessment (Ref 2.4).

Alternatives considered within previous assessments

2.2.3 There have been two previous levels of assessment of alternative options as part of the A737 Improvements at Beith scheme, comprising an assessment in accordance with Scottish Transport Appraisal Guidance (STAG) and an assessment in accordance with the Design Manual for Roads and Bridges (DMRB). These assessments generated options which were then appraised and either eliminated or taken to the next stage as follows.

Design options from the Scottish Transport Appraisal Guidance

2.2.4 A STAG 1 Appraisal was undertaken which generated an initial 17 options. Following the STAG 2 Appraisal four options remained which satisfied objectives in terms of improved trunk road, improved journey time reliability, improved facilities for NMU, improved accessibility for side roads and the local roads network and improved safety throughout.

2.2.5 These four options were as follows:

- a new bypass to the east of existing A737,
- a new alignment of A737 with at-grade single roundabout,
- traffic signals at Head Street/Wardrop Street and Barrmill Road junctions
- two new roundabouts at Head Street/Wardrop Street and Barrmill Road junctions.

2.2.6 The two roundabouts option was redesigned with two variations taken forward, an offline option and an online option.

Design options considered within the DMRB Stage 2 Environmental Impact Assessment

2.2.7 The new bypass option was considered but discounted early on in the design development as it provided poor returns in terms of the Benefit Cost Ratio (BCR) in comparison to the other options being considered, it was significantly more expensive; and had a much greater environmental impact than the other options being considered.

2.2.8 The remaining four options were considered within the Stage 2 EIA. These are described as follows and shown in Drawings 25000199/100/050 to 053:

- Option A – Single Roundabout - This option, constructed offline, would improve the A737 trunk road from north of the B777 Wardrop Street to south of the B706 Barrmill Road (a total length of circa 1300m) and introduce a single roundabout on the trunk road for connection of the side roads thereby eliminating two substandard existing junctions with the trunk road, at the B777 Wardrop Street and at the B706 Barrmill Road. The new single roundabout would be situated approximately mid-way between these side roads.
- Option B – Two Roundabouts Barrmill Offline – This option, constructed offline, would improve the A737 trunk road from north of the B777 Wardrop Street to south of the B706 Barrmill Road (a total length of circa 1400m) and introduce two roundabouts on the trunk road for connection of the side roads thereby eliminating two substandard existing junctions with the trunk road, at the B777 Wardrop Street and at the B706 Barrmill Road. The roundabout for the B777 would be situated at the site of the existing junction and the roundabout for the B706 would be situated offline to the east of the trunk road and to the north of the side road.
- Option C – Two Roundabouts Barrmill Online - This option, constructed online, would improve the A737 trunk road from north of the B777 Wardrop Street to south of the B706 Barrmill Road (a total length of circa 950m) and introduce two roundabouts on the trunk road for connection of the side roads thereby eliminating two substandard existing junctions with the trunk road, at the B777 Wardrop Street and at the B706 Barrmill Road. The roundabout for the B777 would be situated at the site of the existing junction and the roundabout for the B706 would be situated partially online slightly to the east of the trunk road and to the north of the existing B706 Barrmill Road junction.

- Option D – Traffic Signals - This option would improve the A737 trunk road from north of the B777 Wardrop Street to south of the B706 Barrmill Road (a total length of circa 950m) and introduce two traffic signal controlled junctions on the trunk road for connection of the side roads thereby dealing with two substandard existing junctions with the trunk road, at the B777 Wardrop Street and at the B706 Barrmill Road.

2.2.9 The EIA assessment considered the implications of the scheme upon the DMRB topics which included air quality, noise, ecology, cultural heritage and the water environment. The EIA assessment was then combined with the Stage 2 Engineering Assessment and the Traffic and Economic Assessment, and Option B - Two Roundabouts Barrmill offline was identified as the combined environmental, economic and engineered preferred option to take forward to a DMRB Stage 3 Assessment. A summary of the Stage 2 assessment with details of the preferred environmental options is provided in Appendix 2.1.

2.2.10 This option was presented at a public exhibition held on the 27 March 2015 at Beith Community Centre. Further details of the public exhibition is provided in Chapter 5 Consultations, section 5.3 Methodology.

Stage 3 Design Development

2.2.11 Following feedback gained from local residents during the exhibition, the design was further developed during the Stage 3 design for consideration within this ES. Further details are provided within Chapter 5 Consultation.

2.2.12 Local residents commented during the public exhibition that the impact of the proposed Barrmill Roundabout would be reduced if it could be moved further from the existing B706 Barrmill Road and therefore from the properties adjacent to the existing road. Barrmill Roundabout was therefore moved northeast farther (than the Option B layout) from the existing Barrmill Road by approximately 55m and repositioned nearer Geilsland Road. Moving even farther northeast was limited by acceptable design standards for the realignment of Barrmill Road, which is designed to avoid encroachment on Spier's Old School grounds whilst tying into the repositioned roundabout. This Barrmill Road east realignment is therefore a longer more sinuous alignment than Option B. The Barrmill Road west realignment (from the roundabout to Beith) is however a shorter less sinuous alignment than Option B.

2.2.13 It was acknowledged during the Stage 2 Value for Money workshop (VFM2) in January 2015 that extending the tie-in point from near the old railway bridge between Barrmill Road junction and Manrahead Roundabout farther south to Manrahead Roundabout should be considered during Stage 3 design development to eliminate the would-be relatively short section of substandard road from the Option B tie-in point to Manrahead Roundabout.

2.2.14 A number of potential tie-in points between the vicinity of the old railway bridge and Manrahead Roundabout were examined during Stage 3 design development and it was concluded that extension of the scheme to tie in at Manrahead Roundabout was the most appropriate option for the south tie-in. This amendment to the proposed trunk road results in a wholly offline alignment from Head Street Roundabout to Manrahead Roundabout and leaves the old railway bridge structure unaffected by proposals.

2.2.15 This alignment introduced the possibility of incorporating a Differential Acceleration Lane (DAL) in the northbound direction from Manrahead Roundabout. A preliminary economic assessment was carried out and it was concluded that the additional cost of a DAL was justified by the potential benefits from inclusion of the section of dedicated overtaking provision. A 280m long northbound DAL was therefore incorporated into the scheme from Manrahead Roundabout towards Barrmill Roundabout. The proposals include amendment to Manrahead Roundabout to extend it on its south side to provide requisite deflection for southbound traffic from the scheme.

2.2.16 The drainage design has been developed for the Stage 3 assessment commensurate with the changes to the scheme layout. Additional Sustainable Urban Drainage System (SuDS) basins have been incorporated as follows: at the north tie-in (north of the Head Street Roundabout); at the tie-in of the longer realigned Barrmill Road east with the existing B706 opposite the south corner of Spier's Old School grounds and at the west side of Manrahead Roundabout to cater for the extended south tie-in. These are in addition to the basin proposed under Option B between Head Street Roundabout and Barrmill Roundabout, which remains part of the scheme. The principle of the drainage design remains to filter run-off, collect and attenuate in the SuDS basins and outfall at controlled discharge rates to existing watercourses via existing drainage network systems.

2.3 Project description

2.3.1 This scheme was identified as an option during the Scottish Transport Appraisal Guidance (STAG) appraisals in December 2013 and subsequently assessed as the preferred scheme (against other options) at the end of Stage 2 Assessment in February 2015.

2.3.2 The primary philosophy behind the scheme is to improve the A737 trunk road from north of the B777 Wardrop Street to Manrahead Roundabout (a total length of circa 1800m) and introduce two roundabouts on the trunk road for connection of the side roads thereby eliminating two substandard existing junctions; at the B777 Wardrop Street and at the B706 Barrmill Road. The roundabout for the B777 is situated at the site of the existing junction but the roundabout for the B706 is situated offline to the east of the trunk road and to the north of the side road.

2.3.3 This scheme layout (Drawing No. 25000199/100/158 with cross-section drawings detailing vertical and horizontal alignments in Drawings 25000199-100-145 to 151) satisfies objectives in terms of improved trunk road, improved journey time reliability, improved facilities for non-motorised users (NMUs), improved accessibility for side roads and the local road network and improved safety throughout.

2.3.4 Details of the methods utilised during construction and the programme of works are described in Chapter 3 Construction, Operation and Maintenance. The scheme is described in the following paragraphs generally from north to south.

Northern Tie-in to existing A737

2.3.5 The tie-in between the scheme and the existing A737 trunk road is circa 270m north of the existing B777 junction. The existing trunk road at this point is approximately 8m wide (including narrow hardstrips and median strip).

2.3.6 The proposed road widens to a standard (S2) two-lane single carriageway (9.3m wide including 1m hardstrips) and continues to widen further (carriageway width being 12.8m) to develop a 3.5m wide central ghost-island right-turning lane to provide safer access to the filling station situated just north of the existing B777 junction. The proposed trunk road is on a right-hand curve generally at much the same level as the existing trunk road and gradually diverges from the existing trunk road on its east (southbound) side.

Head Street Roundabout

2.3.7 The proposed B777 Head Street Roundabout is situated slightly offset to the east of the existing A737/Head Street/Wardrop Street crossroads junction. The roundabout has an inscribed circle diameter of 47m and four arms being two for the trunk road, one for a side road connection to the east (Wardrop Street) and one for a side road connection to the west to Beith (Head Street).

2.3.8 The proposed (S2) trunk road is on a left-hand curve after the Head Street Roundabout then a right-hand curve on the approach to the B706 Barrmill Roundabout, which is approximately 365m south of the Head Street Roundabout and positioned in the land between Geilsland Road and Barrmill Road and to the east of the existing Barrmill junction with the trunk road. The road is in embankment (maximum 1.4m above existing ground) for 150m south of Head Street Roundabout then in cutting (maximum 5.4m below existing raised ground to the east of the existing trunk road and north of Geilsland Road) for 100m on approach to the Barrmill Roundabout. This cutting is expected to encounter bedrock at shallow depth below the pronounced raised ground. A proposed footbridge is positioned across the cutting.

Barrmill Roundabout

2.3.9 The proposed Barrmill Roundabout has an inscribed circle diameter of 57.6m and four arms being two for the trunk road, one for a new B706 side road connection to the east and one for a new B706 side road connection to the west to Beith.

2.3.10 The proposed trunk road continues south on a right-hand curve in shallow cutting (up to 1.2m below existing ground) across fields after the roundabout and crosses the existing B706 Barrmill Road 130m south of the proposed roundabout. This crossing is generally 0.6m below existing ground level to assist in screening since the alignment passes between existing dwellings adjacent to the existing B706 Barrmill Road. The proposed trunk road continues on a right-hand curve after crossing the B706 but starts to curve to the left and then straightens to tie-in to Manrahead Roundabout, which is 890m from Barrmill Roundabout.

Manrahead Roundabout

2.3.11 The alignment remains offline to the southeast of the existing trunk road including the tie-in to Manrahead Roundabout. This section of the proposed trunk road is in shallow cutting (generally 1m below existing ground) for 225m after Barrmill Roundabout, then in small embankment briefly before the main cutting (maximum 4.1m below existing

ground) for 400m to a short section of fill locally for tie-in to Manrahead Roundabout. The main cutting is momentarily interrupted where it crosses the abandoned railway line, which is also in cutting at this point. The proposed trunk road is (S2) 9.3m wide for 250m from Barrmill Roundabout and widens to 13.5m wide at 567m from Barrmill Roundabout to cater for a DAL. The DAL is an overtaking section for northbound traffic exiting Manrahead Roundabout whereby the carriageway has three lanes with two available as dedicated overtaking provision. The DAL is 280m long and generally on an uphill incline of 1% increasing to a maximum of 4% at its north end over the transition section back to S2 cross-section.

2.3.12 It is proposed to extend Manrahead Roundabout on its southeast side to accommodate the new trunk road (DAL) arm.

2.3.13 The vertical alignment of the proposed trunk road is initially on a slight uphill incline (0.5%) toward Head Street Roundabout from the north tie-in. The road then falls (maximum 5%) after Head Street Roundabout to a low point 290m south of the roundabout from where it rises again (maximum 2%) for 120m to Barrmill Roundabout. The road falls (maximum 1%) after Barrmill Roundabout for generally 300m south of the roundabout from where the downward incline steepens (maximum 4%) before returning to a 1% downward incline over a 300m approach to Manrahead Roundabout.

2.3.14 The proposed trunk road severs the existing B706 and Geilsland Road on the east side of the existing A737 trunk road.

B777 Wardrop Street and Head Street

2.3.15 The B777 Wardrop Street (east of the proposed trunk road) is realigned slightly to the north of the existing road to meet the new roundabout. The new section is approximately 350m long and has a carriageway width generally of 7.3m but widens on approach to the roundabout and narrows at its east end to tie-in to the existing road. The proposed road falls slightly (maximum 2.5%) towards the roundabout. A new T-junction provides access to a section of the existing road that is retained on the south side of the proposed road to serve the properties on Wardrop Street near the trunk road junction. A footpath is proposed on the north side of the road to tie-in to the existing footpath at the eastern tie-in and to the proposed at-grade crossing of the trunk road just north of Head Street Roundabout.

2.3.16 The proposals for the B777 Head Street (west of the proposed trunk road) are to upgrade the junction over a short distance to tie-in to (forming the west arm of) the proposed roundabout.

New B706 Barrmill Road

2.3.17 The new B706 Barrmill Road (east of the proposed trunk road) is rerouted from a tie-in near the eastern edge of Spier's Old School grounds (approximately 450m east of the existing junction with the A737) on a sinuous alignment (curving left after the east tie-in then right then left again on approach to Barrmill Roundabout) around the old school grounds connecting as the east arm of the proposed roundabout. The new section is approximately 420m long and has a carriageway width generally of 7m but widens on smaller radii curves and on approach to the roundabout and narrows at its east end to tie-in to the existing road.

2.3.18 The proposed road is relatively flat at its eastern tie-in with the existing road from where it is on an uphill incline (maximum 2.8%) to the proposed Barrmill Roundabout. New T-junctions are proposed for access to Spier's Old School grounds on the eastbound side and for access to a section of the existing road that is retained on the westbound side to serve the 45 Barrmill Road and 2 Spiersland Way properties. A more minor junction serves the access track to the SuDS basin and fields on the westbound side between the Spier's and old road junctions. A footpath is proposed on the north (eastbound) side of the road to tie-in to the existing footpath at the eastern tie-in and to the new footbridge at Geilsland Road.

2.3.19 The new B706 Barrmill Road (west of the proposed trunk road) is a right-hand curve on approach to the roundabout from a tie-in with the existing urban road network opposite the existing Glebe Road junction. The new section is approximately 110m long and has a varying carriageway width in excess of 8m due to widening around the 80m radius curve and on approach to the roundabout. A footpath is proposed on both sides of the road to tie-in to the existing footpaths at the western tie-in, to the new footbridge at Geilsland Road and to the footpath provision utilising the would-be old trunk road.

2.3.20 Geilsland Road would be stopped-up east of the proposed trunk road but connected to Beith for non-motorised users via a new footbridge. The existing trunk road between the B777 and the south tie-in at Manrahead Roundabout is no longer used for motorised vehicles with the exception of access to dwellings around the existing Barrmill Road junction and is therefore available for enhanced provision for non-motorised users

(NMUs). Most of the provision for NMUs is shared use footpath / cycle track at 3m wide forming a network comprising the would-be old trunk road and the north side of the new side roads. The connections across the new trunk road are via the footbridge near Geilsland Road and via at-grade uncontrolled crossing point just north of the Head Street Roundabout. This at-grade crossing point incorporates a central island (approximately 3m wide) facilitating a two-stage crossing.

Lighting, noise and visual screening and drainage

2.3.21 It is proposed to provide street lighting on the new trunk road from north of Head Street Roundabout to south of Barrmill Roundabout and on the side road approaches to the roundabouts. Footpaths / cycle tracks would also be illuminated.

2.3.22 Noise and visual screening is proposed primarily in the section of trunk road on approach from the south and around Barrmill Roundabout. Screening will be via earth bunds where lateral space permits and screen fencing where lateral space is restricted, which is the case at the section between 16 and 45 Barrmill Road.

2.3.23 Proposed drainage is via filter drains with kerb drainage units at roundabouts and cut-off ditches at earthworks interfaces (tops and bottoms of side slopes). SuDS basins are proposed on the southbound side of the trunk road at the north tie-in, on the northbound side between Head Street and Barrmill roundabouts, on the westbound side of the B706 near the eastern tie-in to the existing Barrmill Road and on the west side of Manrahead Roundabout. The principle of the drainage design is to filter run-off, collect and attenuate in the SuDS basins and outfall at controlled discharge rates to existing watercourses via the existing drainage network systems. Further details on the construction of site drainage and the permanent drainage can be found in Chapter 3 Construction, Operation and Maintenance, Section 3.2.

2.4 Traffic Data

Overview of S-Paramics microsimulation

2.4.1 As part of the DMRB Stage 2 Assessment of the A737 Improvements at Beith, Amey developed an S-Paramics microsimulation model of the study area using S-Paramics 2013.1 microsimulation software. This model replicates the movement of individual vehicles within the study area, resulting in a detailed representation of the speeds and volumes of vehicles on each part of the modelled network.

2.4.2 Microsimulation modelling is capable of capturing various aspects of traffic operation in greater detail and with potentially greater accuracy than traditional average speed based methods of traffic modelling. This includes (from the Analysis of Instantaneous Road Emissions User Manual (AIRE) User Manual, Transport Scotland, June 2011 Ref 2.5):

- Factors for a wide range of heavy vehicles (HGVs, buses, coaches, etc.)
- Detailed modelling of the impact of key network features such as gradient and speeds on bends
- A high level of flexibility in coding and modelling the operating characteristics of different vehicle types (eg light, medium and heavy vehicles, public service and slow moving vehicles)
- Accurate representation of the variation in traffic flows using time-based profiles of travel demand by vehicle type and origin/destination (eg different traffic flow profiles can be used for different movements and/or directions)
- Detailed modelling of individual vehicles and the interaction between for example cars and slower moving vehicles at junctions, in platoons, and during overtaking manoeuvres (eg more robust outputs for environmental assessment including the representation of variation in acceleration and speed within each individual trip, identification of downstream impacts and benefits etc).

2.4.3 S-Paramics provides detailed outputs such as traffic flows, journey times (average, minimum, maximum), queuing (lengths and duration), and vehicle speeds (average, minimum, maximum). This information is available in user-specified time frames, from a minimum interval of 5 minutes, enabling changes in traffic conditions by time of day to be captured.

2.4.4 Vehicle proportions are included as an input to the modelling software, derived from classified vehicle counts with vehicle-type specific growth factors applied (where appropriate) for modelling of future year traffic.

Description of Beith base year traffic model

2.4.5 The model covers a 24 hour, typical weekday, and is modelled using four time periods, namely; AM peak (7.00am to 10.00am), Interpeak (10.00am to 4.00pm), PM peak (4.00pm to 7.00pm) and Offpeak (7.00pm to 7.00am).

2.4.6 The model extends along the A737 trunk road from a point approximately 1.5km north of Clerksbridge Toll Roundabout to approximately 1.5km south of Manrahead

Roundabout and incorporates the main accesses to the trunk road along this section. The extents of the modelled network are shown in Figure 2.1 and outlined below:

- A737 – 1.5km north of Clerksbridge Toll to 1.5km south of Manrahead Roundabout.
- Local roads (for approximately 500m from the A737) – Roebank Road, Head Street, Wardrop Street (B777), Geilsland Road, Barrmill Road (B706) (east and west of A737), Dalry Road B777 to Gateside
- Local accesses – Thomson's of Beith Garage.

2.4.7 The local network within Beith town centre has not been included within the model as the options developed through the A737 Improvements at Beith STAG Appraisal aimed to minimise any impact on the local network. Since the options taken forward to the DMRB assessment were not expected to alter traffic patterns within Beith, the inclusion of the Beith town centre network was not considered necessary.

2.4.8 The Stage 2 base model was created using a comprehensive data set collected specifically for the scheme in October 2013, and calibrated and validated against the criteria outlined in the DMRB Volume 12 (Ref 2.6). Data used to develop the model included the following:

- Twelve hour (07.00am to 7.00pm), weekday classified junction turning counts at each of the major junctions within the study extents (Clerksbridge Toll, Roebank Road, entrances to the garage, Head Street/B777, Geilsland Road, Barrmill Road and Manrahead Roundabout) (in 5 minute intervals)
- Weekday peak period queue length surveys (7.00am to 10.00am, 4.00pm to 7.00pm in 5 minute intervals)
- Weekday journey time surveys (7.00am to 10.00am, 12.00pm to 2.00pm, 4.00pm to 7.00pm)
- Automatic Traffic Counters at three locations on the A737 within the scheme extents, carried out over two weeks (24hr traffic volume and speeds)
- ATC count data at Transport Scotland permanent counter site JTC00084 located to the north of Roebank Road (provided long term traffic count data)

2.4.9 The Stage 2 base model was audited by CH2M Hill as Transport Scotland's Traffic and Transportation Advisers and Auditors (TTAA) who confirmed that the model was fit for purpose.

2.4.10 Moving forward to Stage 3 DMRB assessment, this model has been used to inform the base scenario. Traffic data collected at JTC00084 indicates that there has been little change in traffic levels since 2013 and therefore it was not considered necessary to update the base year traffic model.

Description of Beith future year traffic model

2.4.11 Traffic forecasting has been undertaken by SiAS Ltd on behalf of Transport Scotland using a project specific CUBE model, based largely on TMfS 12 (Transport Model for Scotland 2012 (Ref 2.7)). This model uses a cordoned area of the Scotland-wide TMfS12 model, encompassing key routes within North Ayrshire which include the A737, A736, A760, B777 and B760. TMfS is informed by Transport Scotland's National Land Use Model 'TELMoS' (Transport and Economic Land-use Model of Scotland) which provides independent demographic, planning and economic forecasts to form the basis for future travel demands.

2.4.12 The purpose of the Beith CUBE model is to provide an estimate of future traffic levels in North Ayrshire and identify the potential influence of the proposed option on the routing behaviours along the A737 and parallel routes. It has also been used to identify the impact of Dalry Bypass on vehicle routing. The A737 / A738 (Dalry Bypass) has been granted Scottish Ministers' approval to proceed to Made Orders, following Public Local Inquiry in May 2015. Consequently, Dalry Bypass is included within the core scenarios in all forecast years. It should also be noted that proposed improvements at A737 The Den, to the south of Beith, are not considered to influence traffic behaviour and therefore have no impact on this study.

2.4.13 To improve the reliability and response of the TMfS12 submodel at a local level, additional junction coding was included to provide a measure of capacity and delay at key junctions within the model which are considered influential in routing decisions, including the B706/A737 and B777/A737 junctions at Beith, and the signalised junctions in Dalry town centre and Kilwinning town centre. Full details on the development of this model are provided in the model development report, "Forecasting Model Development Note, SiAS Ltd, November 2015".

2.4.14 The Beith CUBE model has provided traffic data for the years 2013, 2018, 2022, 2027, 2032 and 2037 for three key weekday hours:

- AM peak: 7.00am to 8:00am
- Interpeak: 12.00pm to 1.00pm

- PM peak: 5.00pm to 6.00pm

2.4.15 These peak hour forecasts have been applied proportionally to each hour within the four time periods in the Paramics model (Note that the Offpeak period assumes Interpeak growth).

2.4.16 There were four scenarios tested:

- Core reference case: Do-Minimum (including Dalry Bypass)
- Core option: Option (including Dalry Bypass)
- Sensitivity reference case: Base (no Dalry Bypass)
- Sensitivity reference case: Option_NDB (no Dalry Bypass)

2.4.17 The model disaggregates growth factors for cars, light goods vehicles and heavy goods vehicles.

2.4.18 Testing of the forecast demands within the more detailed S-Paramics models showed that the forecast traffic levels on the A737 mainline created operational issues throughout the model in the later forecast years. For example, significant queuing developed on approach to Manrahead Roundabout and Clerksbridge Toll Roundabout. This occurred in forecast years 2027 onwards and suggests that this level of growth would not be accommodated by the trunk road network without significant improvements along the length of the A737. For this reason, growth has been capped at 2022. All future year assessment beyond 2022 will use 2022 traffic values.

3 Construction, Operation and Maintenance

3.1 Construction programme

3.1.1 The construction of the scheme, subject to satisfactory progression of the statutory process is currently programmed to commence in late 2017, with the construction period expected to be approximately 12 months in duration. The Contractor shall be responsible for preparing his own programme for the construction works which will require approval by the Employer's Representative on site. This programme will be required to take account of any restrictions contained in the Contract and ES.

3.2 Construction method

3.2.1 Construction of the scheme will involve the following components of work:

- Advance works
- Temporary works, such as drainage control
- Temporary compounds and storage areas
- Site clearance
- Temporary traffic management
- Permanent drainage including Sustainable Urban Drainage Systems (SuDS)
- Construction of earthworks
- Construction of road pavement
- Construction of footbridge and culvert structures
- Completion of civils including safety barriers, lighting, fencing signing
- Environmental mitigation
- Post construction maintenance and management.

Advance works

3.2.2 To reduce complexity and facilitate the programming of the main construction works, there may be an opportunity to undertake advance works to divert existing services. Statutory Undertakers (ie Public Utilities) will be consulted regarding any such works.

3.2.3 British Telecom, Scottish Power, Scotia Gas Networks and Scottish Water have apparatus within the existing road boundary and will be affected by the scheme. Diversion work

may be carried out using the Undertakers' own access rights (wayleaves) or where this is not appropriate, land will be acquired by temporary servitude to ensure these works can be completed but much of the diversionary work will take place on the land acquired for the scheme.

Temporary works

3.2.4 To control run-off and prevent pollution of watercourses, temporary drainage is likely to be required prior to the construction of the permanent drainage system, particularly during earthworks operations.

3.2.5 Any restrictions on the location and design of drainage control will be specified within the construction contract and the Contractor will be required to liaise with the Scottish Environment Protection Agency (SEPA) to obtain the necessary licences where applicable. The Employer's Representative for the works will monitor the compliance with the contract requirements on site.

3.2.6 There may be a requirement for the construction of sections of temporary carriageway in order to maintain traffic flows during construction, for example at the junctions for the B777 Head Street, the B706 Barrmill Road and at Manrahead Roundabout whilst the new roundabouts are being constructed and temporary traffic management implemented.

Temporary compounds and storage areas

3.2.7 The Contractors' site offices, compounds and storage areas will be established at appropriate locations in the vicinity of the construction activities and adjacent to the main works site. The exact location(s) for these has not been determined nor assessed as part of this ES as these will be considered by the Contractor at a later stage, within the restrictions imposed by the Contract and this ES.

3.2.8 Contract restrictions will ensure that the compounds are sited appropriately; away from watercourses and sensitive locations identified in this ES to ensure that no permanent environmental impacts occur.

3.2.9 Where areas for compounds are identified and agreed, topsoil will be stripped and the area covered with placed and compacted granular material to establish an area of hard-standing to accommodate the offices, car parks and welfare facilities. Main compounds will generally require connections to mains water, foul water, and electricity and telecommunications networks.

3.2.10 The Contract will require that all compound areas are reinstated to the satisfaction of the affected landowner and within any restrictions imposed by this ES.

Site clearance

3.2.11 Prior to any work starting on site, existing environmental features to be retained will be identified and protected eg existing vegetation, stone walls etc. Any ecological mitigation work required to be implemented in advance of site works will be carried out under ecological supervision prior to site clearance. Tree protection fencing will be erected prior to the start of works where necessary and maintained in place for the duration of the construction period.

3.2.12 Prior to construction commencing in any particular area, clearance of the site will include:

- Removal of fencing, gates and the like
- Felling of tress and removal of other vegetation as specified
- Removal of redundant road furniture such as signs.

3.2.13 Plant for such operations may include dozers, tracked and rubber wheeled excavators and dump trucks or road wagons for removal of cleared materials.

3.2.14 It is intended that materials will be re-used where possible, but where this cannot be achieved materials will be removed from site to licensed landfill. The Contractor shall be responsible for the disposal of material and for obtaining any licenses as appropriate.

Temporary traffic management

3.2.15 The proposed scheme has been designed with the new carriageway predominantly parallel and offline from the existing A737. This helps constructability and to minimise the impacts of temporary traffic management on the A737 trunk road and surrounding area. Temporary traffic management will be required at the tie-ins (where new roads meet existing roads) and at junction areas.

3.2.16 During construction there will be a requirement for temporary traffic management in order to provide safe working areas for construction plant and operatives while maintaining traffic flows on the A737 trunk road. To minimise accidents and safeguard health, reduced speed limits will be implemented as appropriate to the traffic management arrangement during construction for the protection of the workforce and travelling public. Temporary barriers will also be implemented where appropriate to further safeguard workers and the travelling public during construction.

3.2.17 The contract will contain specific restrictions regarding traffic management and routing of vehicles to and from the site.

Control of site drainage during construction

3.2.18 Control of site drainage during construction is covered within Chapter 15 Road Drainage and the Water Environment. The Contractor will be required to consult and comply with the requirements of SEPA when planning and implementing construction. It is anticipated that the Contractor will adopt recognised and established construction practices including storage and attenuation, to avoid impacts on watercourses during construction. The Contract will require that this is detailed in the Contractor's Construction Environmental Management Plan (CEMP). The use of the permanent SuDS basins for temporary control of discharge during construction will not be permitted.

Permanent drainage

3.2.19 The nature of existing watercourses, flooding and drainage outfall locations is described within Chapter 15 Road Drainage and the Water Environment of this ES. The overall drainage strategy for the scheme has been developed in accordance with the requirements of the DMRB, SuDS and through consultation with SEPA.

3.2.20 The primary function of the road drainage is to ensure that the carriageway and associated infrastructure drains effectively. The key objective being to ensure that surface run-off is controlled and treated as near to source as possible to protect downstream habitats without polluting the local environment.

3.2.21 Construction of the permanent drainage will require excavation of trenches and installation of filter drains as well as earthworks associated with SuDS features including swales and attenuation basins.

Construction of earthworks

3.2.22 The construction of earthworks will involve the creation of embankments and cuttings along the route using a variety of heavy plant and machinery. All acceptable excavated material is likely to be re-used and at this stage there is expected to be a balance of acceptable material excavated from site and the required volume of acceptable material for fill but there will be an overall surplus of unacceptable material excavated. As much of this unacceptable material as practicable will be used on-site for landscape fill and re-contouring of adjoining areas to avoid the need for disposal off-site. This is discussed in greater detail in Chapter 11 Materials with respect to resource use and waste.

Construction of road pavements

3.2.23 Construction of the road pavement will involve importing sub-base (crushed stone material forming the lower layer of the pavement) and bituminous materials to the site from quarries or bitumen plants. Where possible, the Contract will include for the requirement to recycle existing road pavement materials into the new road pavement layers. This is discussed in greater detail in Chapter 11 Materials.

3.2.24 Pavement finishes include features such as road markings, signs, safety barriers, and other ancillary works. New signing will generally be limited to warning signs, regulatory signs and information signs associated with accesses, lay-bys and the end of the differential acceleration lane where it reduces back to single carriageway (S2) cross section.

3.2.25 The existing A737 in this location is largely unlit but it is proposed that the roundabouts and adjoining carriageways are lit for the scheme.

Construction of footbridge and culvert structures

3.2.26 The proposed scheme includes the introduction of a footbridge over the proposed trunk road near the existing Geilsland Road. The footbridge will be in an offline area so can be constructed without affecting existing traffic since it is proposed to stop-up Geilsland Road as part of the scheme.

3.2.27 Existing piped culverts may be replaced with new pipes and some may be of sufficient diameter to be considered as structures. Construction of these replacement culverts will require careful planning with respect to traffic management.

Landscaping and planting

3.2.28 New planting will be undertaken as part of the scheme. New landscape planting will be aimed at minimising negative visual and landscape impacts resulting from the scheme on road users and surrounding properties. Planting will use native species as appropriate and details of all landscape mitigation measures are given in Chapter 8 Landscape Effects.

3.2.29 Following construction, the Contractor will be required to manage and maintain all landscaping for a period of five years.

3.3 Construction activities and controls

3.3.1 The environmental performance of the Contractor throughout the works will be defined and controlled through a CEMP and Site Waste Management Plan (SWMP), both to be prepared by the Contractor. This will be in compliance with current legislation and regulations and industry best practice. This plan will be approved by the Employer before the works commence.

3.3.2 The underlying strategy is to retain on site materials arising from the excavation where possible, reduce construction waste and minimise materials needing to be brought onto site through a combination of good design and industry construction best practice, reuse felled tree and other vegetation for ecological improvement or as part of the landscape scheme and manage construction traffic movement.

Hours of work

3.3.3 It has been assumed for this ES that regular construction activities will be undertaken during daytime periods of 7.00am to 7.00pm Monday to Friday and 7.00am to 1.00pm on Saturday. The Contractor will not generally be permitted to work on a Sunday or public holiday.

3.3.4 The Contractor would be required to obtain permission in advance from the Employer's Representative and North Ayrshire Council if it is found necessary to work outwith the hours outlined above.

Control of dust

3.3.5 To minimise the risk of causing a statutory nuisance, recommendations are made within Chapter 6 Air Quality to ensure that the chosen Contractor adopts best practicable means (BPM) in controlling dust emissions during construction activities.

3.3.6 Specific measures to control dust during construction in the vicinity of properties at 16 and 45 Barrmill Road and 2 Spiersland Way will be required in the Contract documentation, given the proximity of the proposed works to the dwellings.

Control of noise

3.3.7 In addition to the assumed limitations on hours of work above, the Contractor will be required to comply with the contents and recommendations of BS 5228: "Code of Practice for Noise Control on Construction and Open Sites", together with the site specific restrictions included in the Contract as necessary and agreed with the North Ayrshire Council.

3.3.8 The Contractor will also be required to confirm consent from the Employer's Representative for the use of all types of construction plant used on the basis that this shall be the quietest of its type practical for carrying the work required and that it is maintained in good condition with regard to minimising noise output in accordance with the methodology of BS 5228.

3.3.9 Specific measures to control noise during construction in the vicinity of properties at 16 and 45 Barrmill Road and 2 Spiersland Way will be required in the Contract documentation, given the proximity of the proposed works to the dwellings.

3.4 Post construction maintenance

3.4.1 Following completion of the scheme, the Contractor will be required to carry out defect and maintenance works for a prescribed period. After this time, responsibility for maintenance will revert to the operating company under their trunk road maintenance contract with Transport Scotland.

4 Environmental Impact Assessment Process and Method

4.1 Introduction

4.1.1 This chapter describes the general process for undertaking Environmental Impact Assessment (EIA) and the approach for the Stage 3 assessment set out in the Design Manual for Roads and Bridges (DMRB) Volume 11, Environmental Assessment (Ref 4.1).

4.1.2 The key objectives of good environment assessment as set out in the DMRB Volume 11 Section 2 Part 1 are to:

- Facilitate good design to minimise environmental impacts. Assessments should support the minimisation of significant environmental effects by firstly amending the design to avoid them and then reduce, compensate or offset those that remain.
- Help decision makers understand the effects from a project and allow them to be considered through the consenting process.

4.2 EIA process

4.2.1 EIA refers to the whole process by which information regarding the likely environmental effects of a project is systematically collected, assessed, publicised and taken into account in accordance with the requirements of the EIA Regulations. The level of assessment carried out must be fit for purpose and proportionate to the potential for the project to cause significant environmental effects.

4.2.2 The assessment process follows a systematic approach of screening to determine whether statutory EIA needs to be completed or not, scoping the environmental topics and the level of assessment required, followed by undertaking the assessment itself and reporting the findings.

4.2.3 The following paragraphs provide further detail on each of the stages.

Screening

4.2.4 The process for deciding whether it is necessary to carry out an EIA and publish an Environmental Statement (ES) is called screening.

4.2.5 As identified in paragraph 1.21, the EIA Directive puts an emphasis on significant effects and is translated into law in Scotland by the Roads (Scotland) Act 1984 as amended and by the EIA regulations.

4.2.6 EIA is mandatory for projects listed in Annex I of the EIA Directive and Annex II projects that are likely to have significant environmental effects having regard to the selection criteria in Annex III. All projects not listed in Annex I, (except strictly maintenance projects), fall under Annex II of the EIA Directive. To determine whether or not Annex II projects are relevant, thresholds of project size and environmental sensitivity are defined in the EIA Regulations. In Scotland, these thresholds are defined in Part 3 of the Environmental Impact Assessment (Scotland) Regulations 1999 as amended by The Environmental Impact Assessment (Scotland) Amendment Regulations 2006.

4.2.7 For Annex II projects that are "relevant projects" a determination process must be followed that meets the requirements of the EIA Regulations. Some degree of assessment work is required to inform the screening process and enable a determination to be made. It is essential that determinations are soundly based, but also that the assessment is appropriate and proportionate to the potential significant effects of the project.

4.2.8 For trunk road schemes, a Record of Determination or RoD must record the screening assessment undertaken and the judgement used, including the views of statutory bodies, to inform the determination on behalf of the Scottish Ministers. The determination has to be made available to the public and is then referred to as the "Notice of Determination". A Notice of Determination must be published for each relevant project considered in accordance with the EIA Regulations.

4.2.9 If an Annex II project falls below the thresholds of size and is not located within any environmentally sensitive areas then it is not considered to be a relevant project and can be screened out of the formal EIA process. For these projects no determination process or EIA is required.

Scoping

4.2.10 Scoping is undertaken to determine which environmental topics are to be included in the statutory EIA. Scoping can also be used to identify the data and survey needs to inform the assessment process and to determine the appropriate assessment levels (either simple or detailed).

4.2.11 Scoping can be on-going as new information becomes available or alternatives are narrowed to a preferred approach to the project. Consultation is undertaken to facilitate the process and this can be through internal means or include external stakeholders.

4.2.12 The results of the scoping exercise are agreed with the Overseeing Organisation and provide the basis for further assessment throughout the project design.

4.2.13 The results of the Stage 2 EIA for this project determined that there would be no significant impacts on the following topic areas:

- Air Quality (Chapter 6), Cultural Heritage (Chapter 7), Landscape (Chapter 8), Nature Conservation (Chapter 9), Geology and Soils (Chapter 10), Noise and Vibration (Chapter 12), Effects on all Travellers (Chapter 13), and Road Drainage and the Water Environment (Chapter 15).

4.2.14 The Stage 2 EIA determined that significant impacts would be experienced in the following topic areas:

- Materials (Chapter 11) and Community and Private Assets (Chapter 14).

4.2.15 However, following a public exhibition on 27 March 2015, and in agreement with Transport Scotland, none of the environmental topic areas will be scoped out of this assessment.

4.3 EIA methods

DMRB

4.3.1 The DMRB Volume 11 is currently in the process of being updated and revised by Highways England (HE), with some topics having been recently updated (for example Noise and Vibration in November 2011) while others are now somewhat outdated (for example Landscape, which dates back to 1993). Sections 1 and 2 of Volume 11, which provide overall guidance on environmental assessment and the structuring of environmental reports, have been revised, and some of the individual topic guidance does not now conform to this overall advice.

4.3.2 In order to cope with this situation, the HE issued the Interim Advice Note (IAN) 125/09 "Supplementary Guidance for Users of DMRB Volume 11" (Ref 4.2). Some topics (Landscape and Ecology and Nature Conservation) have been partially updated through the publication of IANs. The following table summarises the changes to the environmental assessment topic headings in the DMRB Volume 11.

Table 4.1: Changes to environmental assessment topic headings in DMRB volume 11

Previous topic	New topic	DMRB guidance reference
Air Quality	Air Quality	HA207/07 IAN
Cultural Heritage	Cultural Heritage	HA208/07
Landscape Effects	Landscape	HA 209* IAN 135/10 Landscape and Visual Effects Assessment
Ecology and Nature Conservation	Nature Conservation	HA210* IAN 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment
Geology and Soils	Geology and Soils	Volume 11 Section 3 Part 11 Geology and Soils
-	Materials	HA212* IAN 153/11 Guidance on the Environmental Assessment of Material Resources
Noise and Vibration	Noise and Vibration	HD213/11 – Revision 1
Vehicle Travellers	Effects on All Travellers	HA214*
Pedestrians, Cyclists, Equestrians and Community Effects	Community and Private Assets / Effects on All Travellers	HA214* and HA215*
Land Use	Community and Private Assets	HA215*
Road Drainage and the Water Environment	Road Drainage and the Water Environment	HD45/09
Policies and Plans	-	-
*These DMRB Guidance documents are not available at time of writing this ES		

4.3.3 In accordance with DMRB Volume 11 Section 3 Part 12 on policies and plans, each topic assesses the impact of the scheme on relevant policies and planning context within each chapter.

4.3.4 IAN 125/09 states that the new reporting structure should be followed, introducing new topic headings such as Effects on All Travellers, and that where new guidance to match those topic headings has not been prepared, a combination of relevant aspects of the existing topic guidance should be followed as appropriate. The Effects on All Travellers chapter combines the previous topic of Pedestrians, Cyclists and Equestrians with Vehicle Travellers. The Community and Private Assets chapter combines the previous topics of Community Effects and Land Use.

4.3.5 IAN 125/09 has now been superseded by IAN 125/15 (Ref 4.3) Environmental Assessment (October 2015), however Transport Scotland have requested the assessment is undertaken in accordance with IAN 125/09 as the EIA had commenced well in advance of the publication of IAN 125/15.

4.3.6 Guidance for the Materials topic is contained within IAN 153/11 (Ref 4.4), Guidance on the Environmental Assessment of Material Resources.

4.3.7 Guidance within the current DMRB is for the level of environmental assessment at each stage of the project to be determined according to what is appropriate and necessary to establish the likely level of environmental effects which may inform a project decision, and that this level of assessment may vary between topics. Volume 11 now uses the terms simple and detailed assessments, each of which can take place at various stages of the project.

4.3.8 For example, if it is established at an early date that a given project will have no effects in terms of ecology, it may not be necessary to carry out further, more detailed assessment as the project proceeds, or (conversely) if it is evident from the outset that significant effects in terms of water quality are likely to occur, then a detailed assessment may be appropriate at an early stage. A combination of simple and detailed assessments has therefore been used in the preparation of the ES, as set out in the methodology sections of the individual topic chapters.

4.3.9 This assessment has been undertaken in accordance with the guidance provided in the DMRB Volume 11, Sections 2 and 3, and further supported by guidance from relevant IANs as agreed with Transport Scotland.

4.3.10 The DMRB Volume 11 Section 2 Part 5 (HA205/08) (Ref 4.5) provides guidance on the Assessment and Management of Environmental Impact Assessment, which is explained in the following sections.

Baseline characterisation and determination of receptor sensitivity

4.3.11 Each environmental topic defined a study area from which baseline information for each topic is obtained from undertaking the following activities:

- Desk top study and consultation
- Site visits by appropriately qualified staff
- Expert surveys of mammals, reptiles, fish, invertebrates, birds and habitats

4.3.12 A value of sensitivity is determined for each baseline feature (receptor) identified. Table 4.2 illustrates the typical descriptions for each sensitivity value. Where there is any deviation from the standard procedure, this is detailed in the relevant topic chapter methodology section.

4.3.13 It is important to note that multiple receptors are often identified within each topic area for example, within Nature Conservation there is potential to identify designated sites, habitats, mammals, birds, fish and reptiles. Each of these may have different sensitivities and have the potential to experience different impacts.

Table 4.2: Determination of receptor sensitivity

Sensitivity	Description
Very High	Very high importance and rarity, international scale and very limited potential for substitution
High	High importance and rarity, national scale and limited potential for substitution
Medium	High or medium importance and rarity, regional scale, limited potential for substitution
Low	Low or medium importance and rarity, local scale
Negligible	Very low importance and rarity, local scale

Determination of impact magnitude

4.3.14 The magnitude of the impacts on each receptor is determined by the degree of change (positive or negative) caused to a resource or damage experienced by the resource. The magnitude of each impact is assessed following the methodology detailed within each chapter, and is assessed for each topic in two stages. These are during construction (temporary impacts) and operation (permanent impacts).

4.3.15 Impacts during construction are temporary impacts related solely to construction, for example dust or noise generated from plant, whereas the impacts post construction are the long term impacts, such as loss of habitats relating to the provision of the road, or changes in air quality due to increased traffic on the road. Table 4.3 illustrates the standard criteria descriptors for impact magnitude.

Table 4.3: Determination of impact magnitude

Magnitude of impact	Description
Major	Loss of resource and/or quality and integrity of receptor, severe damage to key characteristics, features or elements
	Large scale or major improvement of receptor quality, extensive restoration or enhancement, major improvement of attribute quality
Moderate	Loss of resource, but not affecting integrity, partial loss of /damage to key characteristics, features or elements
	Benefit to or addition of key characteristics, features or elements. An improvement of attribute quality
Minor	Some measurable change in attributes, quality or vulnerability, minor loss of or alteration to one (possibly more) key characteristics, features or elements
	Minor benefit to or addition of one (possibly more) key characteristics, features or elements, some beneficial impact on attribute or a reduced risk of a negative impact occurring
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements
	Very minor benefit to or positive addition of one or more characteristics, features or elements
No Change	No loss or alteration of characteristics, features or elements, no observable impact in either direction

Assessment of Impact

4.3.16 Impact significance is determined by considering the receptor sensitivity and the impact magnitude. The more sensitive the receptor, and the greater the impact magnitude, then the greater the impact significance. This is illustrated in Table 4.4 Significance Matrix, which shows all of the potential impact significance outcomes of the assessment process.

4.3.17 The process requires the assessor to apply reasoned argument, professional judgement and consideration of the views and advice of appropriate organisations. In some cases the significance is shown as being one of two alternatives. Where this occurs, a single description is decided upon and a reasoned judgement included for the level of significance chosen.

4.3.18 Impact significance is determined for impacts identified during construction and post construction. It is important to note that impact significance will be either positive (beneficial) or negative (adverse). Within this report all impacts are negative unless otherwise stated.

Table 4.4: Significance matrix

		Magnitude of impact (degree of change)				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Receptor sensitivity	**Very high**	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

4.3.19 In Scotland, impact significance is first determined without taking mitigation into account, and then again with mitigation in place termed residual impacts. This process allows the effectiveness of any mitigation to be described.

4.3.20 For the purpose of this assessment all impacts with a significance assigned as moderate or above will be deemed to be significant impacts.

Mitigation

4.3.21 Under the EIA Regulations, an ES must provide a description of the measures that when implemented are considered to prevent, reduce and remedy significant negative environmental impacts.

4.3.22 It should be noted that some measures may mitigate more than one impact for example, planting can reduce negative visual impacts but also improve ecological habitat and also that measures put in place to mitigate one impact may have a detrimental impact on another receptor. For example, a noise barrier may cause a negative visual impact.

4.3.23 It is important that measures are put in place to ensure legal compliance, but some measures may also require ongoing monitoring to ensure they are implemented successfully. All mitigation that requires monitoring should be included within a Construction Environmental Management Plan.

4.3.24 Where mitigation is required by legislation this can be considered as essential mitigation and is taken into consideration in the assessment process. Only desirable mitigation that has been agreed with the Overseeing Organisation is considered in the assessment process.

Cumulative impact

4.3.25 At individual topic level, the impact on a receptor may be assessed as non-significant however, when the impacts from each topic on a single receptor are considered in combination, the resulting cumulative impact may be significant.

4.3.26 It is useful to consider the following factors in determining the significance of cumulative impacts:

- Which receptors are affected?
- How does the activity affect the condition of the receptor?
- What is the probability of such effects occurring?

- What ability does the receptor have to absorb other effects before the change becomes irreversible?

4.3.27 The five categories described in Table 4.5 below are used to determine the significance of cumulative impacts.

Table 4.5: Determination of cumulative impact significance

Significance	Description of impact
Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised
Major	Effects that may become key decision-making issue
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance
Minor	Effects that are locally significant
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change

Limitations of the ES

4.3.28 Difficulties encountered in obtaining information, such as land access, survey timing and other constraints in undertaking assessments, are required to be identified within the ES. Details of any relevant information are provided within each topic chapter.

4.3.29 All environmental survey reports provided, and the ES provide references for the age and sources of information.

5 Consultation

5.1 Introduction

5.1.1 This chapter describes the consultation process undertaken as part of the EIA and the ES. Consultation with stakeholders and members of the public has provided an iterative and ongoing input to the progression of the scheme throughout the design process. The methods used to collect information from consultees are described, followed by information on the purpose and benefits of the consultation process. To conclude, details of consultees and key issues raised are highlighted and summarised in Table 5.1.

5.2 Consultation

5.2.1 The purpose and benefits of consultation are to:

- Ensure that statutory consultees and other non-statutory bodies with a particular interest in the environment are informed of the scheme and are provided with an opportunity to comment, in line with the DMRB assessment guidelines
- Consult relevant bodies to obtain baseline information regarding existing environmental site conditions
- Actively encourage local groups to comment on the proposed design and highlight any problems which can be mitigated before they arise
- Establish key environmental issues and identify potential impacts to be considered during the environmental assessment.

5.3 Methodology

Stage 2

5.3.1 A list of consultees was assembled from guidelines provided within the relevant DMRB topics, from statutory bodies with responsibilities or interests in the area and from a review of any local interests or charitable groups within the local area. Consultees were initially contacted by letter in November 2014 as part of the DMRB Stage 2 EIA; providing information on the four improvement scheme options and to request baseline information, records and comments concerning the four options.

5.3.2 Following a combined environmental, economic and engineered assessment of the options, the preferred, Option B - Two Roundabouts Barrmill offline, was presented at a

public exhibition held on the 27 March 2015 at Beith Community Centre. Feedback gained from local residents and stakeholders during the exhibition helped develop the design to the Stage 3 design for consideration within this ES.

Public exhibition

5.3.3 A public exhibition was held in Beith Community Centre on Friday 27 March 2015 to present the preferred option for the A737 improvement scheme from the Stage 2 EIA. There were several approaches to maximise the number of attendees. Prior to the exhibition, letters were sent out inviting elected officials and affected landowners to ensure their presence was requested at the exhibition. In addition to invitations, approximately 20 posters publicising the event were distributed locally informing the public of the exhibition.

5.3.4 Amey prepared exhibition boards which provided information on the background to the scheme, an overview of the options discounted through the assessment process and an indication of the next steps in the scheme development. These boards were displayed in Beith Library for a period of time after the exhibition. To further enhance the visual exhibition, Amey presented a live demonstration of the S-Paramics traffic model of the preferred option on a large screen. Additionally, press releases were published in the following local newspapers:

- Ayr Advertiser Series
- Carrick Herald
- Ardrossan and Saltcoats Herald
- Cumnock Chronicle
- Irvine Times
- Largs and Milport Weekly News.

5.3.5 A total of 292 members of the public registered their attendance at the event however it is expected that the overall attendance was greater due to a number of attendees not registering. Attendees were encouraged to provide feedback via a comments form to help inform the design development. A total of 70 formal responses were received either by comments forms or email following the event.

Stage 3

5.3.6 Further letters were sent to consultees identified during Stage 2 and those identified in December 2015 as part of the DMRB Stage 3 assessment to request additional comments on the impacts of the preferred scheme and latest proposals to inform the EIA process. All responses are detailed within Appendix 5.1. Where no response was obtained from the formal consultation letter, the consultee was contacted by email and telephone and if no response was obtained at this point, it was assumed the consultee had no comment.

5.3.7 As part of the land use assessment, eight land owners were asked to complete an Agricultural Land Use questionnaire (Appendix 5.2) to enhance the assessment. This was carried out by face to face meetings, emails and telephone calls in January 2016.

5.4 Key issues raised by consultees

5.4.1 Table 5.1 Environmental Statement Consultees provides details of all Stage 3 consultations undertaken as part of the ES and the main issues raised

Table 5.1: Environmental Statement consultation

Consultee	Date and Method of Response	Response	Relevant Chapter and Action Required
Ayrshire Rivers Trust	27 January 2016 Letter	ART have no issues with the proposed improvement scheme. ART would advise that any necessary precautions are taken where work falls near a watercourse to ensure that the risk of pollution is minimised. There is the risk that pollution could enter the nearby Powgree Burn during the construction phase and have a negative impact on the freshwater ecology. The Powgree burn is an important tributary of the River Garnock, both of which have good populations of salmon, trout, eels and sticklebacks. ART would recommend as good practice, a monitoring programme which would assess fish and invertebrate populations on the Powgree Burn which could be affected during construction of the improvement scheme. ART will be able to design and implement a monitoring plan should Amey desire	Chapter 9 Ecology and Nature Conservation and Chapter 15 Road Drainage and the Water Environment Necessary precautions are taken where work is near a watercourse to ensure that the risk of pollution is minimised. ART would recommend as good practice, a monitoring programme which would assess fish and invertebrate populations on the Powgree Burn.
Beith Cultural and	14 January 2016	No formal responses in relation to the proposals were	Chapter 7 Cultural Heritage

Consultee	Date and Method of Response	Response	Relevant Chapter and Action Required
Heritage Society	Email	received. Comments relating to the wider aspects of the scheme are on-going with design engineers	None required
British Geological Society	No response received		
The British Horse Society (BHS)	20 January 2016 Email	The BHS have been consulting local riders within Beith, however have not had a huge response. They have attached an advice sheet and asked for Amey to work with them on specific design elements if necessary.	Chapter 13 Effects on all Travellers and Chapter 14 Community and Private Assets Ensure the BHS are consulted regarding equestrians if any issues arise during the design stage.
British Trust for Ornithology	No response received		
Cyclists Touring Club (CTC) Right to Ride	No response received		
Friends of Spiers	No response received		

Consultee	Date and Method of Response	Response	Relevant Chapter and Action Required
Historic Environment Scotland	7 January 2016 Letter	HES can confirm that there are no heritage assets within their remit within the proposed development area or its vicinity, and consequently they are content that significant impacts arising from the proposed development are unlikely. Therefore they have no comments to offer on the baseline or potential impacts of the proposal. HES have recommended that Amey consult North Ayrshire Council's archaeological and conservation services on these details. They will also be able to provide information on the baseline and potential impacts, including issues beyond HES remit, such as category B and C listed buildings, and unscheduled archaeology.	Chapter 7 Cultural Heritage None required.
RSPB	No response received		
Scotways	No response received		
Scottish Badgers	4 January 2016 Letter via Email	Scottish Badgers can confirm that no new badger records have been received at the office and therefore the status remains the same. It has been noted that a	Chapter 9 Ecology and Nature Conservation The badger survey (2015)

Consultee	Date and Method of Response	Response	Relevant Chapter and Action Required
		badger survey has been carried out during the spring of 2015 and would only ask that this be updated prior to works commencing given the time lapse and that the normal precautions should be taken by the workforce should they encounter any setts not previously found and or reported.	must be updated prior to works commencing. Precautions should be taken by the workforce should they encounter any setts not previously found and or reported.
Scottish Right of Way and Access Society	No response received		
Scottish Ornithological Society	No response received		
Scottish Wildlife Trust	No response received		
SEPA	5 January 2016 Letter	There is no objection from SEPA to the proposed layout of the scheme. Previous comments regarding waste, SuDS and requirements for authorisation under the Water Environment (Controlled Activities) (Scotland) 2011 remain unchanged.	Chapter 10 Geology and Soils, Chapter 11 Materials and Chapter 15 Road Drainage and the Water Environment Ensure previous comments are adhered to and continue

Consultee	Date and Method of Response	Response	Relevant Chapter and Action Required
			to consult SEPA throughout the design process.
SNH	7 January 2016 Letter	SNH are not aware of any natural heritage interests within the immediate vicinity of the proposed development area. However, they have advised that Amey refer to the SNH guidance and information to ensure that appropriate protected species surveys are carried out.	Chapter 9 Ecology and Nature Conservation Ensure SNH guidance is used when carrying out protected species surveys.
Sustrans	No response received		
The James Hutton Institute	No response received		
Tandleview Stables	No response received		
West of Scotland Archaeology Service	28 January 2016 Letter	The WoSAS main issue with the proposed layout is likely to relate less to its possible impact on recorded archaeological sites than to the potential for ground disturbance associated with construction to encounter and remove previously-unrecorded buried archaeological material. This potential would be directly related to the amount of fresh ground disturbance	Chapter 7 Cultural Heritage WoSAS have suggested a programme of evaluation trenching and a requirement for archaeological monitoring during the initial removal of turf and topsoil

Consultee	Date and Method of Response	Response	Relevant Chapter and Action Required
		required for construction. WoSAS have suggested a programme of evaluation trenching along the line of the proposed new sections of road and related infrastructure; which would be carried out in advance of the main construction phase, and could result in the need for a second phase of work should significant archaeological features be identified. Also a requirement for archaeological monitoring during the initial removal of turf and topsoil from the line of the road.	from the line of the road.
North Ayrshire Council – Roads Department	No response received		
North Ayrshire Council, Ranger service	No response received		
North Ayrshire Council - Flood Risk Management Officer	No response received		
North Ayrshire Council Petroleum Officer	18 January 2016 Letter	There is one petroleum site situated on the proposed stretch of carriageway and therefore consideration	Chapter 10 Geology and Soils

Consultee	Date and Method of Response	Response	Relevant Chapter and Action Required
		should be given to any earth removal and vibration close to any underground petroleum tanks. Water dispersal should be kept to a minimum. The site has a three stage interceptor, therefore consideration must be given to any drainage works.	Consideration should be given to any earth removal or vibration in close proximity to any underground petroleum tanks.
North Ayrshire Council Planning Services	22 December 2015 Email	The adopted North Ayrshire Local Development Plan (2014) fully supports the upgrading of the A737 in order to improve the connectivity of North Ayrshire to the central belt for economic development purposes. The additional works included in the revised scheme are noted and welcomed. It is considered that the additional works would result in various benefits to all modes of transport as well as meeting the various scheme objectives set out by Transport Scotland for the safety and efficiency of the trunk road. The land use planning implications of the proposal are as follows: - enhanced and safer pedestrian connectivity between	Chapter 13 Effects on all Travellers and Chapter 14 Community and Private Assets None required

Consultee	Date and Method of Response	Response	Relevant Chapter and Action Required
		Beith and the Geilsland School/Speirs School grounds, both of which now have community uses that are likely to develop further in the future; - enhanced pedestrian and cycling connectivity between Beith and the new Garnock Campus via the proposed cycle/pedestrian route along the line of the existing A737, which would link to existing footpath connections on the B777 west to Glengarnock; - enhanced connectivity between Beith and the outlying villages of Barrmill and Gateside; - increased capacity at Manrahead Roundabout which reflects committed and future developments within North Ayrshire that are likely lead to additional traffic flows on the A737.	
North Ayrshire Council – Contaminated Land	21 December 2015 Email	A Noise Impact Assessment would require to be undertaken to assess any potential detrimental effects of noise on nearby sensitive dwellings and to ensure appropriate mitigation measures can implemented. A copy of this should be submitted to North Ayrshire	Chapter 12 Noise and Vibration Noise impact assessment is required and a copy to be sent to NAC.

Consultee	Date and Method of Response	Response	Relevant Chapter and Action Required
		Council for consideration.	
North Ayrshire Council – Transportation	22 December 2015 Email	In terms of the impact of the development on the design and function of adjacent local roads, they have no objection. It has been stated there are a few issues to be finalised in respect of NMU routes and limits of responsibility however NAC will continue to correspond with Amey during the project.	Chapter 13 Effects on all Travellers None required

6 Air Quality

6.1 Introduction

6.1.1 The Stage 2 EIA report for the scheme as undertaken in line with the Design Manual for Roads and Bridges (DMRB) HA 207/07 Air Quality (Ref 6.1). The Stage 2 EIA concluded that air quality should be fully assessed to establish the impact the anticipated changes to the traffic flow and the realignment of key roads would have on ambient levels of Nitrogen dioxide (NO_2) and particulate matter (PM_{10}).

6.1.2 In order to determine the air quality impacts of the scheme, a simple air quality impact assessment was undertaken as part of the Stage 2 in accordance with guidance in the Design Manual for Roads and Bridges (DMRB) HA 207/07 Air Quality. The Stage 2 EIA predicted levels for NO_2 and PM_{10} well below the air quality objectives in both the baseline year and the future assessment year for all four options and there will be no significant impacts on air quality from any of the options.

6.1.3 This chapter includes an assessment and examination of existing and predicted pollutant sources and measured ambient concentrations in the vicinity of the development site and a comparison with relevant air quality criteria. The potential temporary impacts of the construction phase of the proposed works are also discussed.

6.1.4 The detailed assessment of the potential operational impacts of the scheme on local and regional air quality was undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) HA 207/07 Air Quality. As stated in Design Manual for Roads and Bridges (DMRB) HA 207/07 Air Quality "A detailed assessment should be applied where there exists the potential to cause significant effects on environmental resources and receptors. The objective is to gain an in-depth appreciation of the beneficial and adverse consequences of the project and to inform project decisions". Though the stage 2 concluded there would be no significant impacts on air quality it was decided, in response to concern from local residents at the Stage 2 consultation, to undertake as robust an assessment as is possible.

6.1.5 In direct response to concerns raised by local residents during the Stage 2 public consultation, it was also decided that baseline monitoring should be undertaken to help confirm the findings of the earlier assessments and to also assist in the verification of future modelling.

6.1.6 The assessment of the potential temporary nuisance impacts from construction dust was undertaken in accordance with Institute of Air Quality Management (IAQM) Guidance on the

assessment of dust from demolition and construction (Ref. 6.2). The assessment of dust also includes a recommendation of mitigation options.

6.2 Methodology

Statutory and planning review

6.2.1 A desktop review of current legislation, planning policy, standards and technical guidance was carried out between 1 December 2015 and 31 December 2015 to identify all relevant information to the project in relation to air quality.

6.2.2 The following websites were checked:

- http://www.standardsforhighways.co.uk/ha/standards/index.htm
- https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69334/pb13081-tech-guidance-laqm-tg-09-090218.pdf
- http://iaqm.co.uk/text/guidance/construction-dust-2014.pdf
- http://www.transportscotland.gov.uk/sites/default/files/documents/rrd_reports/uploaded_reports/j9760/j9760.pdf
- http://www.gov.scot/Topics/Environment/waste-and-pollution/Pollution-1/16215/PG09
- https://www.gov.uk/guidance/uk-pollutant-release-and-transfer-register-prtr-data-sets
- http://www.scottishairquality.co.uk/air-quality/standards
- http://naei.defra.gov.uk/data/gis-mapping

Assessment of impact

Temporary impacts during construction

6.2.3 Construction sites can give rise to annoyance due to the soiling of surfaces by dust. Very high levels of soiling can also damage plants and affect the diversity of ecosystems. Additionally, there is evidence of major construction sites increasing long term particulate matter (PM_{10}) concentrations and the number of days when PM_{10} concentrations exceed 50µg/m^3, the daily limit value for this pollutant. Exposure to PM_{10} has long been associated with a range of health effects.

6.2.4 The main effect of any dust emissions, if not mitigated, could be annoyance due to soiling of surfaces, particularly windows, cars and laundry. However, it is normally possible, by implementation of proper control, to ensure that dust deposition does not give rise to significant adverse impacts.

6.2.5 The methodology to assess the temporary impacts from construction on air quality follows the guidance stated in the IAQM Guidance on the assessment of dust from demolition and construction the full methodology of which is detailed in Appendix 6.1

6.2.6 This assessment compares the difference in the air quality climate between a baseline year and a future assessment year scenarios. The baseline and future years for the assessment of temporary air quality impacts (ie from construction activities) are as follows:

- The baseline year is that immediately prior to the start of works (2016)
- The future year is a year during the period of construction works (2017).

6.2.7 The assessment is only undertaken if there are sensitive receptors which could be potentially affected by construction dust. Table 6.1 shows the screening criteria to determine if these sensitive receptors exist.

Table 6.1: Construction dust screening criteria

Receptor type	Screening criteria
A 'human receptor' within	• 350m of the boundary of the site; or • 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s)
An 'ecological receptor' within	• 50m of the boundary of the site; or • 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s)

Permanent impacts post construction

6.2.8 The methodology to assess the permanent impacts from the operation of the scheme follows the guidance stated in the DMRB HA 207/07 as well as the Highway's Agency's Interim Advice Note (IAN) 174/13 Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA207/07) (Ref 6.3).

6.2.9 The air quality assessment for a road scheme has two main elements. The first is the estimation of roadside air pollution concentrations, referred to as local impacts, associated with new or modified road schemes. The second is an estimation of total annual emissions arising from a road scheme, referred to as regional impacts.

6.2.10 This assessment is in accordance with the Detailed assessment methodology in the DMRB HA 207/07 that states that an air quality assessment of local impacts should be undertaken if a scheme results in any of the following criteria being met:

- road alignment will change by 5m or more
- annual average daily traffic flows (AADT) will change by 1000 AADT or more
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more
- daily average speed will change by 10km/h or more
- peak hour speed will change by 20km/h or more.

6.2.11 A regional assessment is required if affected roads are expected to have:

- a change of more than 10% in AADT
- a change of more than 10% to the number of HDVs
- a change in daily average speed of more than 20 km/h.

6.2.12 In the case of this scheme some sections of the carriageway will be widened by 5m or more. As some roads will cease to carry traffic there will also be changes of 10% or more of the AADT on some of the roads.

6.2.13 This assessment considers the air quality climate:

- With the scheme, referred to as the Do-Something scenarios
- Without the scheme, referred to as the Do-Minimum scenarios.

6.2.14 In order to forecast the magnitude of possible impacts these scenarios are assessed for a baseline year and also a future year. The baseline and future years for the assessment of permanent air quality impacts (ie from operation of the scheme) are as follows:

- The baseline year is the opening year of the scheme – 2018.
- The future assessment year is the worst year in the first fifteen years after the opening year of the scheme – in this case 2022.
- The DMRB also recommends a base case year be assessed in order to enable the model to be verified and if needed corrected – 2015.

6.2.15 DMRB HA 207/07 also states that if construction is expected to last for more than six months the effect of the additional constructional vehicles should be assessed as an additional scenario, though this can be a qualitative assessment if detailed traffic flows are not available.

6.2.16 For road traffic sources, the pollutants of particular concern are oxides of nitrogen (NO_x and NO_2) and particulate matter (PM_{10}), which are the most likely pollutants to exceed or approach Air Quality Strategy objectives (ie Scotland AQS objectives) and the EU limit

values. NO_2 and PM_{10} are of concern in relation to human health, whereas oxides of nitrogen (NO_x) are of concern in relation to vegetation and ecosystems. Table 6.2 lists the key traffic related air quality thresholds; for NO_2 these are the same for the UK and Scottish AQS objectives which are also the same as the EU limit values. Though, as detailed in Table 6.2, the Scottish objective for PM_{10} and $PM_{2.5}$ is considerably lower than the UK and EU values.

Table 6.2: Objectives for key traffic related pollutants

Pollutant	Air Quality threshold	Measured as
Nitrogen Dioxide (NO_2)	200μg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40μg/m^3	Annual mean
Oxides of Nitrogen (NO_x)	30μg/m^3	Annual mean
Scotland Only Particles (PM_{10}) (gravimetric)	18μg/m^3	Annual mean
	50μg/m^3, not to be exceeded more than 7 times a year	Daily mean
All Authorities Particles (PM_{10}) (gravimetric)	40μg/m^3	Annual mean
	50μg/m^3, not to be exceeded more than 7 times a year	Daily mean
Scotland Only Particles ($PM_{2.5}$) (gravimetric)	12μg/m^3 (limit)	Annual Mean
All Authorities Particles ($PM_{2.5}$) (gravimetric)	25μg/m^3(target)	Annual Mean
	15% cut in urban background exposure	Annual Mean

6.2.17 As a result of the long range nature of the impact of traffic borne pollutants, in particular NO_x and PM_{10}, a consideration of the change in emissions resulting from the scheme is considered useful in the context of assessing regional air pollution. In addition carbon dioxide accounted for 85% of the United Kingdom's man made greenhouse gas emissions in 2004, and as such is considered the most important greenhouse gas and is used as an indicator of a schemes impact on climate change. Regional air quality emissions for NO_x, PM_{10} and CO_2 were calculated following the simple methodology set out in the DMRB HA 207/07 using the DMRB Screening Model (v1.03c).

6.2.18 All of the roads included in the air quality assessment were considered even though not all of those roads will be subject to change in AADT of 10% or more. This approach enables a more robust assessment of the regional air quality impacts of the scheme.

Assessment of Impact

Temporary impacts during construction

6.2.19 The assessment of the risk of dust impacts is made separately for each potentially adverse construction stage and takes account of:

- the sensitivity of the area (determined from the sensitivity of receptors and the number of receptors)
- the scale and nature of the works, which determines the potential dust emission magnitude at that construction stage.

6.2.20 These two factors (i. sensitivity of the area and ii. scale and nature of the works) are combined to give the risk of dust impacts. These dust impacts are split for each construction stage into:

- dust soiling impacts
- effects on human health of PM_{10}
- ecological impacts.

Permanent impacts post construction

6.2.21 In order to forecast the magnitude of possible impacts, we compared pollution levels with (Do-Something) and without (Do-Minimum) the scheme.

6.2.22 If any of the air quality objectives are likely to be exceeded in either the Do-Minimum or the Do-Something scenarios in any of the years in which they apply, the guidelines in Table 6.3 and Table 6.4 are used to classify the magnitude of the impact.

6.2.23 Modelled air pollutants have some element of residual uncertainty, referred to as Measure of Uncertainty (MoU). This is due to inherent uncertainty in air quality monitoring, modelling and the traffic data used in the assessment.

6.2.24 This report uses the approach to describe the MoU stated in the Interim Advice Note (IAN) 174/13, which at the same time is based around Defra's published advice in the Local Air Quality Management Technical Guidance 09 (LAQM TG 09) (Ref 6.4) on the desirability of

achieving 10% verifications (between modelled and monitored concentrations) where concentrations are close to or above the air quality threshold.

6.2.25 Table 6.3, Table 6.4 and Table 6.5 show the magnitude of change criteria in relation to the MoU stated in the Interim Advice Note (IAN) 174/13. A change of less than 1% of the objective is considered imperceptible. As the objective for NO_2 is 40µg/m^3, a change has to be more than 0.4µg/m^3 to be perceptible. As the objective for PM_{10} is 18µg/m^3, a change has to be more than 0.18µg/m^3 to be perceptible. The same principle has been applied for $PM_{2.5}$.

Table 6.3: Magnitude of impact criteria for NO_2

Magnitude of impact of the change in concentration	Value of change in annual average NO_2
Large (>4)	Greater than full MoU value of 10% of the air quality objective (4µg/m^3)
Medium (>2 to 4)	Greater than half of the MoU (2µg/m^3), but less than the full MoU (4 µg/m^3) of 10% of the air quality objective
Small (>0.4 to 2)	More than 1% of objective (0.4µg/m^3) and less than half of the MoU ie 5% (2µg/m^3). The full MoU is 10% of the air quality objective (4µg/m^3)
Imperceptible (≤0.4)	Less than or equal to 1% of objective (0.4 µg/m^3)

Table 6.4: Magnitude of impact criteria for PM_{10}

Magnitude of impact of the change in concentration	Value of change in annual average PM_{10}
Large (>1.8)	Greater than full MoU value of 10% of the air quality objective (1.8µg/m^3)
Medium (>0.9 to 1.8)	Greater than half of the MoU (0.9µg/m^3), but less than the full MoU (1.8µg/m^3) of 10% of the air quality objective
Small (>0.18 to 0.9)	More than 1% of objective (0.18µg/m^3) and less than half of the MoU ie 5% (0.9µg/m^3). The full MoU is 10% of the air quality objective (1.8µg/m^3)
Imperceptible (≤0.18)	Less than or equal to 1% of objective (0.18µg/m^3)

Table 6.5: Magnitude of impact criteria for $PM_{2.5}$

Magnitude of impact of the change in concentration	Value of change in annual average $PM_{2.5}$
Large (>1.2)	Greater than full MoU value of 10% of the air quality objective (1.2μg/m^3)
Medium (>0.6 to 1.2)	Greater than half of the MoU (0.6μg/m^3), but less than the full MoU (1.2μg/m^3) of 10% of the air quality objective
Small (>0.12 to 0.6)	More than 1% of objective (0.12μg/m^3) and less than half of the MoU ie 5% (0.6μg/m^3). The full MoU is 10% of the air quality objective (1.2μg/m^3)
Imperceptible (≤0.12)	Less than or equal to 1% of objective (0.12μg/m^3)

6.2.26 Under the IAN 174/13, where the outcome of the assessment indicates that either all modelled concentrations are above the air quality objectives or any changes above the air quality objectives where the change is perceptible, then the scheme effect is likely to be significant for local air quality.

6.2.27 As detailed in IAN 174/13 the magnitude of change is focused on "only those receptors exceeding the air quality thresholds in either the 'without scheme' scenario and / or 'with scheme' scenario".

6.2.28 If any of the air quality objectives are likely to be exceeded in either the Do-Minimum scenario or the Do-Something scenario in any of the years in which they apply, the guidelines in Table 6.3 and Table 6.4 above are used to classify the magnitude of the impact.

6.2.29 Table 6.6, Table 6.7 and Table 6.8 are then used to help determine the significance of effect depending on the number of receptors exceeding the air quality thresholds and the magnitude of impact.

Table 6.6: Guideline to number of properties constituting a significant effect for NO_2

	Number of receptors with:	
Magnitude of impact in Annual Average NO_2 ($\mu g/m^3$)	**Worsening of air quality objective already above objective or creation of a new exceedance**	**Improvement of an air quality objective already above objective or the removal of an existing exceedance**
Large (>4)	1 to 10	1 to 10
Medium (>2 to 4)	10 to 30	10 to 30
Small (>0.4 to 2)	30 to 60	30 to 60

Table 6.7: Guideline to number of properties constituting a significant effect for PM_{10}

	Number of receptors with:	
Magnitude of impact in Annual Average PM_{10} ($\mu g/m^3$)	**Worsening of air quality objective already above objective or creation of a new exceedance**	**Improvement of an air quality objective already above objective or the removal of an existing exceedance**
Large (>1.8)	1 to 10	1 to 10
Medium (>0.9 to 1.8)	10 to 30	10 to 30
Small (>0.18 to 0.9)	30 to 60	30 to 60

Table 6.8: Guideline to number of properties constituting a significant effect for $PM_{2.5}$

	Number of receptors with:	
Magnitude of impact in Annual Average $PM_{2.5}$ ($\mu g/m^3$)	**Worsening of air quality objective already above objective or creation of a new exceedance**	**Improvement of an air quality objective already above objective or the removal of an existing exceedance**
Large (>1.2)	1 to 10	1 to 10
Medium (>0.6 to 1.2)	10 to 30	10 to 30
Small (>0.12 to 0.6)	30 to 60	30 to 60

6.2.30 In relation to the regional air quality impacts a quantitative assessment of the change in regional emissions associated with the scheme was undertaken. A comparison is made between the Do-Minimum and Do-Something scenarios for the assessment years of 2018 and 2022.

Compliance Risk Assessment

6.2.31 Development projects are also required to assess the impacts of their scheme on compliance with the EU Directive on ambient air quality (2008/50/EC) (Ref 6.5). The IAN 175/13 (Ref 6.6) sets out the assessment approach for identifying and quantifying impacts of a scheme on Defra's UK National Compliance Assessment for the EU Directive on ambient air quality. This approach uses the reported information from Defra's Pollution Climate Mapping (PCM) (Ref 6.7) model and the results obtained in this air quality assessment.

Modelling

6.2.32 The predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been calculated using the proprietary modelling software ADMS-Roads Air Dispersion Modelling Software Version 3.4 (Ref 6.8). This is a formally validated model used extensively in the UK and internationally for regulatory purposes. Dispersion models combine meteorological data with estimations of emissions from road traffic sources to calculate pollutant concentrations at particular receptor points.

6.2.33 The meteorological data considered to be most representative for the study area was taken from Glasgow Bishopton (for 2014, the most recent year 2015 was not available at the time of writing) which is located approximately 17km to the northwest of the study area. A surface roughness length of 0.5m was applied in the analysis of the meteorological data and a roughness length of 0.5m was applied in the dispersion analysis, this surface roughness is considered suitable for parkland and open suburbia. The wind rose detailing wind direction and speed for the year is in Appendix 6.4.

6.2.34 Estimated modelled concentrations are subject to uncertainty and therefore on occasion need to be adjusted to obtain representative results. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. The verification method followed the process detailed in LAQM TG(09). The full model verification process is detailed in Appendix 6.2.

6.2.35 In July 2011, Defra published a report (Ref 6.9) examining the long term air quality trends in NO_x and NO_2 concentrations. The report indicated that there had been a decrease in NO_2

concentrations between 1996 and 2002, however since this time, NO_2 concentrations have stabilised with little to no reduction between 2004 and 2010. Defra concluded that there is now a gap between current projected vehicle emission reductions and projections on the annual rate of improvements in ambient air quality.

6.2.36 In response to this report, Highways England (formerly the Highways Agency) developed the Long-Term Trend (LTT) Gap Analysis methodology that is detailed within the IAN 170/12 v3 (Ref 6.10). This methodology is used to adjust model predictions and uses the base year vehicle emissions rates and the future year emission rates, and the measured trends in roadside NO_2 concentrations to predict concentrations in future years

6.2.37 The projection factors originally published in the IAN were considered overly pessimistic. In June 2014, Defra updated Box 2.1 in LAQM TG (09) and published new projection figures. The projection figures referenced "HDV <10% UK" in Box 2.1 have been used to undertake the LAQM projection in this scheme assessment.

6.3 Statutory and planning context

National legislation relating to dust

6.3.1 Dust can broadly be considered in two states; firstly while it is suspended in the air and secondly once it has settled out of the air and deposited onto surfaces. Statutory standards exist for suspended dust with an aerodynamic diameter of less than 10µg/m^3 (PM_{10}) and these Air Quality Objectives are detailed in Table 6.2 above. However, for deposited dust (and its tendency for causing a loss of amenity and/or nuisance), no UK statutory standards or limits currently exist.

Environmental Protection Act 1990

6.3.2 Section 79 of the Environmental Protection Act (EPA) 1990 (Ref 6.11) states that where a statutory nuisance is shown to exist, the Local Authority must serve an abatement notice. Statutory nuisances are defined as:

- any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance
- any accumulation or deposit which is prejudicial to health or a nuisance.

6.3.3 Failure to comply with an abatement notice is an offence and, if necessary, the Local Authority may abate the nuisance and recover expenses, as well as potentially seeking prosecution for breach of the notice.

Environment Act 1995

6.3.4 Under Part IV of the Environment Act (Ref 6.12), the UK Air Quality Strategy defines a standard of 50μg/m^3 for ambient concentrations of PM_{10} as a running 24-hour mean.

6.3.5 This limit is for the exposure of the general populace and must not be exceeded more than 7 times in the year. Therefore, following completion of an assessment process, if a Local Authority believes that this (or any other) air quality objective will not be met, it is obliged to declare an Air Quality Management Area within which the aim is to work towards the attainment of that objective.

Regulatory and policy framework relating to Local and Regional Air Quality

6.3.6 European Directive 2008/50/EC on ambient air quality and cleaner air for Europe. The 2008 ambient air quality directive sets legally binding limits for concentrations in outdoor air of major air pollutants that impact public health such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2). As well as having direct impacts, these pollutants can combine in the atmosphere to form ozone, a harmful air pollutant (and potent greenhouse gas) which can be transported great distances by weather systems.

6.3.7 The 2008 directive replaced nearly all the previous EU air quality legislation and was made law in Scotland through the Air Quality Standards (Scotland) Regulations 2010 (Ref 6.13).

6.3.8 Scottish Planning Policy (SPP) (Ref 6.14) is a statement of Scottish Government policy on how nationally important land use planning matters should be addressed across the country. The SPP promotes consistency in the application of policy across Scotland whilst allowing sufficient flexibility to reflect local circumstances. It directly relates to:

- the preparation of development plans;
- the design of development, from initial concept through to delivery; and
- the determination of planning applications and appeals.

6.3.9 This SPP introduces a presumption in favour of development that contributes to sustainable development. Paragraph 29 of this document specifically relates to the consideration of the impacts on air quality.

6.3.10 Planning Advice Notes (PANs) provide advice on good practice and other relevant information. The central purpose of PAN 51: Planning, Environmental Protection and Regulation (Ref 6.15) is to support the existing policy on the role of the planning system in relation to the environmental protection regimes. PAN 51 details the statutory

responsibilities of the environmental protection bodies, as well as informing these bodies about the planning, including the Local Air Quality Management regime.

6.3.11 The UK Government is required under the Environment Act 1995 to produce an Air Quality Strategy (Ref 6.16). This was last reviewed and published in 2007. The strategy sets out the UK's air quality objectives and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. It prescribes air quality objectives for ten pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, polycyclic aromatic hydrocarbons, nitrogen dioxide, sulphur dioxide, particles – PM_{10} and $PM_{2.5}$ and ozone). The air quality objectives applicable to LAQM in Scotland are set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No97) (Ref 6.17) and the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish SI 2002 No 297) (Ref 6.18).

6.3.12 Part IV of the Environment Act 1995 requires local authorities in the UK to review air quality in their area and designate air quality management areas (AQMA) if improvements are necessary. Where an air quality management area is designated, local authorities are also required to work towards the Strategy's objectives prescribed in regulations for that purpose. An air quality action plan describing the pollution reduction measures must then be put in place. These plans contribute to the achievement of air quality limit values at local level.

Local Policy Framework

6.3.13 North Ayrshire Council adopted its Local Development Plan (Ref 6.19) on 20 May 2014. The Plan sets out how North Ayrshire Council aims to guide development and investment in the area over the next twenty years. The Local Development Plan (LDP) area encompasses mainland North Ayrshire, the Cumbraes and the Isle of Arran.

6.3.14 The LDP does not contain any specific policies that relate to local air quality management or the control of dust during construction. However the LDP includes a general policy which explicitly discusses environmental pollution: "*GENERAL POLICY …. (b) Amenity: Development should have regard to the character of the area in which it is located. Regard should be given to the impact on amenity of: …Levels and effects of emissions including smoke, soot, ash, dust and grit or any other environmental pollution;…*"

6.3.15 The North Ayrshire Local Transport Strategy (Ref 6.20) was adopted in May 2015 and states "An overall improved roads hierarchy, with strategic routes upgraded to a standard commensurate with their intended purpose is required. We are already considering potential options for the improvement of our road hierarchy through the North Ayrshire Strategic

Routeing Study, and we will support and work with Transport Scotland to act on the outcomes of the study to realise these improvements". The scheme in Beith is an integral element of these works.

6.3.16 Section 6.8 details how the scheme achieves the local and national planning objectives that relate to air quality.

6.4 Baseline conditions

Dust (Temporary effects)

6.4.1 Beith is located in a rural environment within the district of North Ayrshire. The immediate area consists mainly of medium density residential housing to the west of the scheme and a predominantly rural area to the east of the scheme with a few scattered residential properties. A site visit was carried out on 28 October 2015, other than traffic no other sources of air pollution were identified.

6.4.2 A search of the UK Pollutant Release and Transfer Register website (Ref 6.21), which includes data from SEPA, did not identify any industrial or waste management sources within 350m of the scheme.

6.4.3 There are a total of 1304 residential, 2 community, 4 commercial within 350m of the project and 0 ecological receptors within 50m of the project as shown in Figure 6.1 in the drawings chapter and Table 6.9 below. At the time of writing it is anticipated that all of the construction works will take place within the scheme area.

Table 6.9: Sensitive receptors within the study area for temporary impacts

Cumulative distance bands (m)	Number of receptors			
	Residential	Community	Ecological	Commercial
0-20	64	1	0	0
0-50	174	1	0	1
0-100	402	1		1
0-150	596	2		2
0-200	762	2		2
0-350	1304	2		4

6.4.4 Under Part IV of the Environment Act 1995 it is a requirement to publish an Air Quality Strategy and establish a system of local air quality management. Local authorities are required to review and assess air quality in their area and to designate Air Quality

Management Areas where air quality objectives are unlikely to be met. Where an AQMA has been declared an Air Quality Action Plan, aiming to reduce pollutant levels to meet the objectives, needs to be produced.

6.4.5 A review of the 2015 Air Quality Updating and Screening Assessment for North Ayrshire Council (Ref 6.22) confirms that North Ayrshire Council has not declared any AQMAs, though continues to monitor local air quality at a number of locations.

6.4.6 North Ayrshire Council maintain only one PM_{10} monitoring location. This is situated in Irvine town centre, some 15km to southwest of Beith.

6.4.7 The centre of Irvine is a relatively busy area for traffic with slow moving vehicles and congestion being common at peak times. The section of the Irvine road network, where monitoring is undertaken, is also subject to a high number of bus movements as it serves as a bus terminal.

6.4.8 For completeness the annual mean concentrations and the number of daily mean exceedances for PM_{10} are detailed in Table 6.10 below. However for the reasons detailed above in paragraph 6.4.6 and 6.4.7 the monitoring at this location is not considered representative of the PM_{10} levels in the vicinity of the scheme.

Table 6.10: Measured PM_{10} (at the roadside) at locations closest to the study area

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m^3)		
			2012	2013	2014
High Street Irvine	Roadside	N	17	21	16
			Daily Mean number of exceedances (Days)		
			0	0	0

6.4.9 As there are no local sites deemed representative of local background air quality in the assessment area for 2015 and 2016, background concentrations for PM_{10} were obtained from the latest Scottish pollutant background maps (Ref 6.23). These maps provide a modelled background pollutant concentration for each OS 1km×1km grid square in the UK. Table 6.11 shows the existing baseline concentrations of PM_{10} in the area of the scheme. These values are used to help assess the risk of adverse health impacts associated with the construction phase of the scheme.

Table 6.11: Background concentrations for PM_{10} average of grid reference 234500, 653500 and 235500, 653500

Year	PM_{10} ($\mu g/m^3$)
2016 (Year prior to construction)	10.53
2017 (Year of construction)	10.47

Local Air Quality (Permanent Effects)

6.4.10 In line with the DMRB HA207/07, the study area for permanent air quality impacts is defined by a buffer 200m either side of the centre line of the affected roads. Table 6.12 and Figure 6.2 show the affected roads and sensitive receptors in 50m bands up to 200m. There were no affected roads identified in the local network other than those detailed on figure 6.2 that required further assessment in accordance with DMRB HA 207/07. There are a total of 760 residential, 2 commercial, 4 community receptors and 0 ecological receptors within 200m of affected roads. All residential receptors and community receptors such as schools, hospitals and care homes are assigned a high sensitivity to changes in air quality. There are two commercial residential care homes within 200 metres. There are a total of 4 school buildings that are part of the Giesland Residential School, these have been included in the interests of completeness, but it is understood that at the time of writing that this school is no longer in operation.

Table 6.12: Sensitive receptors within the study area for operational impacts

Distance bands (m)	Number of receptors			
	Residential	Community	Ecological	Commercial
0-50	174	1	0	1
50-100	228	0		0
100-150	193	2		1
150-200	165	1		0
Total	760	4		2

6.4.11 Seventeen residential receptors were chosen as representative worst case receptors given their proximity to the affected roads and they are also shown in Figure 6.2. These receptor locations were chosen due to their proximity to junctions, roundabouts, and new sections of road. Traffic related emissions of NO_2 and PM_{10} are higher at locations where traffic is slower moving and stop start conditions prevail. Table 6.13 below shows the distance of the

selected receptors to the centreline of the relevant affected roads in the study area. The closest façade of each residential property has been chosen, again in order to present a worst case assessment. These receptors are representative of other receptors in the immediate vicinity.

Table 6.13: Air quality representative receptors and distance to the considered links

Receptor Ref	Receptor Grid Ref		Distance to A737 centreline from nearest facade Do minimum	Distance to A737 centreline from nearest facade Do something
	x	y		
SR1	234385	653102	22.3	38.9
SR2	234530	653206	28.5	72.0
SR3	234691	653291	18.4	90.3
SR4	234845	653372	23.0	120.4
SR5 DS	235051	653329	111.4	19.5
SR5 DM	235069	653326	121.9	33.1
SR6	235016	653454	12.05	101.5
SR7 DM	235075	653434	39.5	46.7
SR8 DS	235084	653416	56.9	28.6
SR9	235045	653478	15.4	100.7
SR10 DM	235078	653469	14.2	70.5
SR10 DS	235091	653469	22.1	60.8
SR11 DM	235078	653463	18.4	65.7
SR11 DS	235091	653459	30.3	53.5
SR12	235051	653558	72.1	152.3
SR13	235031	653520	56.8	141.0
SR14	235202	653698	46.5	87.6
SR15	235242	653762	41.6	61.8
SR16	235377	653838	57.9	17.6
SR17	235319	653881	11.0	15.4

6.4.12 As detailed in the 2015 Air Quality Updating and Screening Assessment for North Ayrshire Council the council maintains an extensive network of automatic and passive monitoring stations for NO_2. As is the case with PM_{10} the closest automatic monitoring is located in Irvine High Street some 15km from the scheme. North Ayrshire Council also monitors at an additional 22 locations using passive diffusion tubes. Three of these locations exceeded the annual mean air quality objective for NO_2 in 2014. However as with the automatic monitoring station none of the monitoring locations is in relevant proximity to the scheme and as such are not considered suitable for establishing the baseline conditions.

6.4.13 In September 2015 Transport Scotland commissioned Amey to undertake an air quality monitoring programme in the Beith area. The monitoring aims to establish the ambient concentrations of NO_2 in proximity to the A737 in order to verify the air quality dispersion model outputs. The full details of the proposal are outlined in Air Quality Monitoring Programme – A737 Improvements at Beith (Appendix 6.5 and Ref 6.24).

6.4.14 Seven locations were chosen, six in locations adjacent to the current route of the A737 and one co-located at the North Ayrshire Councils continuous monitoring station in Irvine town centre. This co-located tube has been used to check the precision and accuracy of the diffusion tubes and to correct any bias the tubes have to over or under read, the full details of this are in Appendix 6.3.

6.4.15 LAQM TG (09) states that the "concentrations of some pollutants exhibit seasonal patterns, so all surveys should ideally be carried out for a minimum of six consecutive months (three in summer and three in winter, for example January to June or July to December), to ensure they are representative of the full year".

6.4.16 For this scheme, monitoring commenced in September 2015 and stopped at the end of February 2016. Monitoring resumed in July 2016 and is on-going. LAQM TG(09), presents the ratio of short-term means (three- and six- months) to the annual mean NO_2 concentrations, depending on when monitoring commenced. It shows that a sixth month monitoring programme commencing in September is likely to over-estimate concentrations by approximately 14%. In order to account for this seasonal bias the diffusion tube results have been annualised. Further detail on this process is provided in Appendix 6.3.

6.4.17 The eight months of monitoring data available at the time of writing was "annualised" following the methodology detailed in Box 3.2 in LAQM TG(09). As detailed in the technical guidance roadside sites such as the Irvine monitoring station are not considered suitable for this process, therefore data from the Glasgow Townhead Urban Background (Ref 6.25) and

the Glasgow Waulkmillglen Reservoir continuous monitoring stations was used. The data showed that the measured NO_2 period mean for September 2015 – January 2016 and July – August 2016 compared to the annual mean at these sites has a ratio of 0.85. The ratio of 0.85 was used to annualise the Beith monitoring data in order to represent a full year of data. This adjusted monitoring data was used in the verification of the air quality model.

6.4.18 The monitoring data collected available at the time of the writing is detailed below. The average results for each monitoring location are summarised below in Table 6.14 and the locations are detailed in Appendix 6.1.

Table 6.14: Beith Diffusion Tube Monitoring

Tube ref	Raw Tube Data NO_2µg/m^3	Average NO_2 µg/m^3 Bias Adj *	Annualised** NO_2 µg/m^3 0.85
B	20.70	15.24	12.91
C	40.44	29.47	24.96
D	11.58	8.73	7.40
E	18.97	14.01	11.87
H	26.41	19.35	16.39
J	17.96	13.21	11.19
P	34.87	25.60	21.69

* For 01/09/2015-31/01/2016 a bias adjustment factor of 0.82 was applied and for 15/07/2016-09/09/2016 0.62

** Based on data collected at Glasgow Townhead and Glasgow Waulkmillglen Reservoir Air Quality Monitoring Stations 01/09/2015-31/01/2016 and 15/07/2016-09/09/2016

6.4.19 None of the monitoring locations detailed in Table 6.14 are representative of a background location as the tubes locations were chosen in order to help verify the model and to better understand the existing emissions from the A737.

6.4.20 The background concentrations for NO_x, NO_2, PM_{10} and $PM_{2.5}$ in the assessment area for 2015, 2018 and 2022 were obtained from the latest Scottish pollutant background maps. These maps provide a modelled background pollutant concentration for each OS 1km×1km grid square in Scotland and are detailed in Table 6.15 below. The background maps for NO_x, PM_{10} and $PM_{2.5}$ concentrations are split into source sectors. To avoid double counting of the modelled road sources the "Trunk_A_Rd_in" contribution has been removed from the background NO_x ,PM_{10} and $PM_{2.5}$ concentrations.

Table 6.15: Background concentrations for NO_x, NO_2, PM_{10} and $PM_{2.5}$ in different years from the Defra's background maps 2011 for closest grid references

Year	NO_x (μg/m^3)			NO_2 (μg/m^3)			PM_{10} (μg/m^3)			$PM_{2.5}$ (μg/m^3)		
	x234500 y653500	x235500 y653500	Average	x234500 y653500	x235500 y653500	Average	x234500 y653500	x235500 y653500	Average	x234500 y653500	x235500 y653500	Average
2015	8.64	7.98	8.31	6.63	6.11	6.37	10.54	10.49	10.51	6.65	6.56	6.60
2018	7.97	7.20	7.58	6.08	5.49	5.79	10.35	10.32	10.34	6.49	6.40	6.44
2022	7.47	6.55	7.01	5.64	4.96	5.3	10.17	10.14	10.15	6.33	6.24	6.28

Regional Air Quality

6.4.21 The UK National Atmospheric Emissions Inventory (NAEI) (Ref 6.26) maintain estimates of the regional and national emissions of a number of pollutants. These help track the UK's progress towards international commitments on greenhouse gases (climate change) and harmful air pollutants (air pollution). The NAEI website provides data on regional and national basis, the most recently published data in 2015 was for the year 2013.

6.4.22 The regional emissions associated with road transport for the North Ayrshire region in 2013 are detailed below in Table 6.16.

Table 6.16: Regional Transport Emissions for North Ayrshire

Sector	NO_X as NO_2 tonnes/year	PM_{10} tonnes/year	CO_2 tonnes/year
Road Transport	496	237	160,390

6.5 Impact assessment

Temporary impacts during construction

6.5.1 At the time of writing, the actual construction phase programme, equipment and methodology is unknown. The level of detail, sequence and durations will be developed further in the construction-phase programme following completion of detailed design and appointment of the successful contractor. However, this report is based on a robust initial assessment of the construction phase programme using the best-available knowledge at the time of preparation. This assessment has taken a 350m boundary from the wider scheme area as detailed in Figure 6.1 in Appendix 6.1.

6.5.2 Overall, the following activities on this site are considered to have the potential to generate dust emissions.

- Earthworks: including the removal of topsoil, handling on site and deposition, construction of cuttings and embankments, stockpiling and handling of loose materials (including loading and unloading of materials).
- Construction: including the provision, modification or refurbishment of a structure.

6.5.3 Track out: vehicle movements, causing re-suspension of road dust, particularly on unmade roads. Table 6.17 shows the sensitivity of receptors within the study area for temporary impacts. For dust soiling, the sensitivity of receptors is high due to residential receptors being within 350 metres. Residential receptors can reasonably expect a high

level of amenity and the appearance and aesthetics of their property would be diminished by dust soiling.

6.5.4 The sensitivity of receptors to PM_{10} is also assessed as being high as there is a possibility that members of the public could be exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location is one where individuals may be exposed for eight hours or more in a day such as a residential property). There are no ecological receptors within 50 metres, and as such these impacts have been scoped out.

Table 6.17: Determination of the sensitivity of receptors

Dust effect	**Relevant definition**	**Sensitivity of receptors**
Dust soiling impacts	Residential dwellings	High
Human health effects of PM_{10}	Location where individuals can be exposed for 8 hours or more in a day	High
Ecological impacts	No designated sites within 50 metres of the scheme boundary	N/A

6.5.5 In accordance with the IAQM Guidance on the assessment of dust from demolition and construction only the highest level of receptor sensitivity need be considered. In the case of this scheme having between 10-100 receptors within 20 metres is considered the worst case. According to Table 6.4 as detailed in Appendix 6.1 this rates the sensitivity of the area to dust soiling as being high.

6.5.6 According to Table 6.5 in Appendix 6.1 the sensitivity of the area to human health effects of PM_{10} has been defined as low as there are 10-100 receptors within 20 metres and the background ambient concentration of PM_{10} for 2016 is 10.53µg/m^3 and 10.47µg/m^3 for 2017.

6.5.7 The dust effect sensitivity and the sensitivity of the area for dust soiling and human health impacts of PM_{10} are summarised below in Table 6.18.

Table 6.18: Determination of the sensitivity of the area

Sensitivity of receptors	Relevant definition	Sensitivity of the area
Dust soiling (High)	10-100 receptors within 20m	High
Human health of PM_{10} (High)	10.53µg/m^3 PM_{10} and 10.47µg/m^3 PM_{10} (background concentration 2016 and 2017) 10-100 receptors within 20m	Low

6.5.8 The potential dust emission magnitude is based on the scale and nature of the anticipated works and is classified as small, medium or large (see criteria in Tables 6.7, 6.8, 6.9 and 6.10 in Appendix 6.1). Table 6.19 shows the potential dust emission magnitude for each of the activities expected during the works.

Table 6.19: Determination of the potential dust emission magnitude

Construction stage	Relevant definition	Potential dust emission magnitude
Earthworks	Total site area >10,000m^2 >10 heavy earth moving vehicles active at any one time, silty sandy gravelly CLAY Formation of bunds required 1.5 to 2m in height. Current programme indicates summer early Autumn 2017 working.	Large
Construction	Total construction area is approximately 129,100m^2 though materials have low potential for dust release with no requirement for concrete batching on site.	Medium
Track out	10-50 HDV (>3.5t) outward movements in any one day during earthworks, surface material (dry clay) with high potential for dust release, sections of unpaved road in excess of 100m), 28,000m^3 material removed from site.	Medium

6.5.9 The sensitivity of the area has been defined for both dust soiling and human health impacts as shown in Table 6.18. The dust emission magnitude for each phase of the construction has then been defined as detailed in Table 6.18.

6.5.10 Table 6.20 below summarises the risk of dust impacts to both dust soiling and human health effects for each stage of the construction.

Table 6.20: Summary dust risk table to define site-specific mitigation

Dust effect (sensitivity of the area to the specific dust effect)	Construction Phase (potential dust emission magnitude)		
	Earthworks (Large)	Construction (Medium)	Track out (Medium)
Dust soiling (High)	High	Medium	Medium
Human health of PM_{10} (Low)	Low	Low	Low

Permanent impacts post construction

Local air quality

6.5.11 A detailed assessment of air quality within 200 metres of the affected roads around the scheme was undertaken, in order to assess the impact of the new scheme on the worst case residential receptors and within the wider network considered to be affected.

6.5.12 The methodology adopted enables quantitative predictions of ambient pollution levels to be made for two scenarios in the opening year; Do-Minimum (DM) 2018 and Do-Something (DS) 2018 and for the future year; Do-Minimum (DM) 2022 and Do-Something (DS) 2022.

6.5.13 For each appropriate section, speeds, AADTs of LDVs and HDVs and distance of the receptor from the centreline are detailed and the pollutant emissions are calculated. The traffic data used in this assessment is detailed in Appendix 6.6.

6.5.14 A comparison of the predicted NO_2 concentrations at worst case residential receptors for the Do-Minimum and Do-Something scenarios for the base case year 2015, the baseline year 2018 and future year 2022 is presented in Table 6.21 and Table 6.22 below. In accordance with IAN 170/12 v3 the LAQM TG (09) LTT Gap predictions are detailed. The magnitude of impact of the change in pollutant concentrations is assessed against the descriptors listed in IAN 174/13 and as summarised earlier in Table 6.3.

6.5.15 As discussed in section 6.21, the IAN 174/13 states that the change in concentration "is focused on **only those receptors exceeding the air quality thresholds** in either the 'without scheme' scenario and / or 'with scheme' scenario." As detailed below none of the worst case receptors are predicted to exceed the air quality threshold, but for completeness the change in concentration and the magnitude of change are detailed.

6.5.16 For 2018, when compared against the IAN 174/13 descriptors for impact magnitude, seven of the worst case receptors are predicted to see a medium beneficial impact on ambient concentrations of NO_2. Of the 13 remaining receptors, nine will see a small beneficial impact, three a small adverse impact and one will be imperceptible. As detailed in Table 6.21 the scheme will not result in any new exceedances of the annual mean air quality objective for NO_2 with the highest Do-Something predicted concentration of NO_2 being 14.63/m^3 at receptor SR17 which is detailed on Figure 6.2.

Table 6.21: Predicted NO_2 concentration at specific receptors 2018

Receptor Ref	Base 2015 µg/m^3	DM 2018 µg/m^3 using LAQM TG(09) projection	DS 2018 µg/m^3 using LAQM TG(09) projection	Change µg/m^3	Magnitude of Change
SR1	12.02	11.23	9.36	-1.87	Small
SR2	9.17	9.44	8.15	-1.29	Small
SR3	10.18	10.84	8.21	-2.64	Medium
SR4	9.73	10.22	7.91	-2.30	Medium
SR5 DS	7.62	7.29	8.65	1.36	Small
SR5 DM	7.82	7.51	8.06	0.55	Small
SR6	11.99	13.00	8.78	-4.23	Medium
SR7 DM	9.29	9.22	8.87	-0.35	Imperceptible
SR8 DS	8.55	8.36	9.36	1.00	Small
SR9	12.77	13.01	9.06	-3.95	Medium
SR10 DM	12.07	12.14	9.31	-2.82	Medium
SR10 DS	10.33	10.33	9.18	-1.15	Small
SR11 DM	11.01	11.02	9.11	-1.91	Small
SR11 DS	9.56	9.48	9.01	-0.47	Small
SR12	9.27	10.02	8.92	-1.09	Small

Receptor Ref	Base 2015 µg/m^3	DM 2018 µg/m^3 using LAQM TG(09) projection	DS 2018 µg/m^3 using LAQM TG(09) projection	Change µg/m^3	Magnitude of Change
SR13	10.14	10.53	9.46	-1.07	Small
SR14	8.56	11.05	7.85	-3.20	Medium
SR15	8.65	11.38	8.14	-3.24	Medium
SR16	9.39	10.80	12.01	1.21	Small
SR17	12.53	16.07	14.63	-1.44	Small

6.5.17 For 2022, when compared against the IAN 174/13 descriptors for impact magnitude, five of the worst case receptors are predicted to see a medium benefit, six a small benefit, four will be imperceptible and five receptors will see a small adverse impact on ambient concentrations of NO_2. As detailed in Table 6.22 the scheme will not result in any new exceedances of the annual mean air quality objective for NO_2 with the highest predicted Do-Something concentration of NO_2 being 14.22/m^3 at receptor SR17.

Table 6.22: Predicted NO_2 concentration at specific receptors 2022

Receptor Ref	DM 2022 µg/m^3 using LAQM TG(09) projection	DS 2022 µg/m^3 using LAQM TG(09) projection	Change µg/m^3	Magnitude of Change
SR1	12.19	9.34	-2.85	Medium
SR2	9.19	8.13	-1.05	Small
SR3	10.59	8.48	-2.12	Medium
SR4	9.96	8.15	-1.81	Small
SR5 DS	7.06	8.08	1.02	Small
SR5 DM	7.29	7.72	0.43	Small
SR6	12.71	9.31	-3.40	Medium
SR7 DM	8.94	8.70	-0.23	Imperceptible
SR8 DS	8.11	8.88	0.78	Small
SR9	12.67	9.54	-3.13	Medium

Receptor Ref	DM 2022 µg/m^3 using LAQM TG(09) projection	DS 2022 µg/m^3 using LAQM TG(09) projection	Change µg/m^3	Magnitude of Change
SR10 DM	11.80	9.60	-2.20	Medium
SR10 DS	9.92	9.13	-0.79	Small
SR11 DM	10.68	9.23	-1.45	Small
SR11 DS	9.12	8.84	-0.28	Imperceptible
SR12	8.91	8.70	-0.21	Imperceptible
SR13	9.79	9.19	-0.60	Small
SR14	8.29	7.79	-0.50	Small
SR15	8.41	8.03	-0.39	Imperceptible
SR16	9.34	11.22	1.88	Small
SR17	13.51	14.22	0.71	Small

6.5.18 A comparison of the predicted PM_{10} concentrations at selected receptors for the DM and DS scenarios for the years 2018 and 2022 is presented in Table 6.23 and Table 6.24 below. The road portion of PM_{10} has been corrected using the same NO_2 verification factor as detailed in Appendix 6.2. The magnitude of impact of the change in pollutant concentrations is assessed against the DMRB criteria as summarised in Table 6.4.

6.5.19 For 2018, when compared against the DMRB HA 207/07 descriptors for impact magnitude, eight of the worst case receptors are predicted to see a small medium benefit and three a small adverse impact on ambient concentrations of PM_{10}. Nine will be imperceptible. As detailed in Table 6.23 the scheme will not result in any new exceedances of the annual mean air quality objective for PM_{10} with the highest predicted concentration of PM_{10} being 11.26µg/m^3 at receptor SR17.

Table 6.23: Predicted PM_{10} concentration at specific receptors 2018

Receptor Ref	Base 2015 µg/m³	DM 2018 µg/m³	DS 2018 µg/m³	Change µg/m³	Magnitude of Change
SR1	11.14	10.99	10.80	-0.19	Small
SR2	10.88	10.76	10.55	-0.22	Small
SR3	11.06	10.95	10.50	-0.45	Small
SR4	10.98	10.87	10.47	-0.40	Small
SR5 DS	10.64	10.47	10.76	0.29	Small
SR5 DM	10.66	10.49	10.62	0.13	Imperceptible
SR6	11.30	11.19	10.52	-0.67	Small
SR7 DM	10.86	10.69	10.66	-0.02	Imperceptible
SR8 DS	10.76	10.59	10.81	0.22	Small
SR9	11.29	11.13	10.55	-0.58	Small
SR10 DM	11.18	11.02	10.61	-0.41	Small
SR10 DS	10.96	10.80	10.65	-0.15	Imperceptible
SR11 DM	11.05	10.89	10.62	-0.28	Small
SR11 DS	10.87	10.71	10.66	-0.04	Imperceptible
SR12	10.81	10.65	10.59	-0.06	Imperceptible
SR13	10.90	10.72	10.62	-0.11	Imperceptible
SR14	10.78	10.66	10.52	-0.14	Imperceptible
SR15	10.80	10.68	10.56	-0.12	Imperceptible
SR16	10.87	10.72	11.07	0.36	Small
SR17	11.36	11.25	11.26	0.01	Imperceptible

6.5.20 For 2022, when compared against the DMRB descriptors for impact magnitude, eight of the worst case receptors are predicted to see a small benefit and three receptors a small adverse impact on ambient concentrations of PM_{10}. Eight will be imperceptible and there will be no change at R17. As detailed in Table 6.24 the scheme will not result in any new exceedances of the annual mean air quality objective for PM_{10} with the highest predicted concentration of PM_{10} being 11.04µg/m³ at receptor SR17.

Table 6.24: Predicted PM_{10} concentration at specific receptors 2022

Receptor Ref	DM 2022 µg/m³	DS 2022 µg/m³	Change µg/m³	Magnitude of Change
SR1	10.99	10.57	-0.41	Small
SR2	10.58	10.34	-0.24	Small
SR3	10.77	10.31	-0.46	Small
SR4	10.69	10.28	-0.41	Small
SR5 DS	10.28	10.55	0.27	Small
SR5 DM	10.30	10.42	0.12	Imperceptible
SR6	11.01	10.32	-0.69	Small
SR7 DM	10.50	10.46	-0.04	Imperceptible
SR8 DS	10.40	10.60	0.20	Small
SR9	10.94	10.35	-0.59	Small
SR10 DM	10.84	10.41	-0.43	Small
SR10 DS	10.62	10.45	-0.17	Imperceptible
SR11 DM	10.71	10.42	-0.29	Small
SR11 DS	10.52	10.46	-0.06	Imperceptible
SR12	10.45	10.38	-0.06	Imperceptible
SR13	10.52	10.40	-0.12	Imperceptible
SR14	10.45	10.32	-0.12	Imperceptible
SR15	10.46	10.37	-0.10	Imperceptible
SR16	10.52	10.87	0.35	Small
SR17	11.04	11.04	0.00	No Change

6.5.21 A comparison of the predicted $PM_{2.5}$ concentrations at selected receptors for the DM and DS scenarios for the years 2018 and 2022 is presented in Table 6.25 and Table 6.26 below. The road portion of $PM_{2.5}$ has been corrected using the same NO_2 verification factor as detailed in Appendix 6.2. The magnitude of impact of the change in pollutant concentrations is assessed against the DMRB criteria as summarised in Table 6.5.

6.5.22 For 2018, when compared against the DMRB HA 207/07 descriptors for impact magnitude, six of the worst case receptors are predicted to see a small benefit and three

receptors a small adverse impact on ambient concentrations of $PM_{2.5}$. Ten will be imperceptible and there will be no change at R17. As detailed in Table 6.25 the scheme will not result in any new exceedances of the annual mean air quality objective for $PM_{2.5}$ with the highest predicted concentration of $PM_{2.5}$ being 6.97 µg/m^3 at receptor SR17.

Table 6.25 Predicted $PM_{2.5}$ concentration at specific receptors 2018

Receptor Ref	Base 2015 µg/m^3	DM 2018 µg/m^3	DS 2018 µg/m^3	Change µg/m^3	Magnitude of Change
SR1	6.99	6.82	6.70	-0.11	Imperceptible
SR2	6.83	6.68	6.56	-0.12	Imperceptible
SR3	6.93	6.79	6.53	-0.26	Small
SR4	6.89	6.74	6.52	-0.23	Small
SR5 DS	6.68	6.51	6.68	0.16	Small
SR5 DM	6.70	6.53	6.60	0.07	Imperceptible
SR6	7.08	6.92	6.54	-0.38	Small
SR7 DM	6.81	6.64	6.62	-0.01	Imperceptible
SR8 DS	6.75	6.58	6.71	0.13	Small
SR9	7.08	6.89	6.56	-0.33	Small
SR10 DM	7.01	6.83	6.60	-0.23	Small
SR10 DS	6.88	6.70	6.62	-0.09	Imperceptible
SR11 DM	6.94	6.76	6.60	-0.16	Small
SR11 DS	6.82	6.65	6.62	-0.03	Imperceptible
SR12	6.79	6.62	6.58	-0.04	Imperceptible
SR13	6.84	6.66	6.60	-0.06	Imperceptible
SR14	6.77	6.64	6.54	-0.09	Imperceptible
SR15	6.78	6.65	6.57	-0.08	Imperceptible
SR16	6.82	6.66	6.86	0.20	Small
SR17	7.12	6.97	6.97	0.00	No Change

6.5.23 For 2022, when compared against the DMRB descriptors for impact magnitude, nine of the worst case receptors are predicted to see a small benefit, seven will be imperceptible and three receptors a small adverse impact on ambient concentrations of $PM_{2.5}$. At R17,

the highest concentration of $PM_{2.5}$ of 7.02µg/m^3 is predicted for the Do-Minimum and Do-Something scenarios. As detailed in Table 6.26 the scheme will not result in any new exceedances of the annual mean air quality objective for $PM_{2.5}$ w at receptor SR17.

Table 6.26 Predicted $PM_{2.5}$ concentration at specific receptors 2022

Receptor Ref	DM 2022 µg/m^3	DS 2022 µg/m^3	Change µg/m^3	Magnitude of Change
SR1	6.98	6.63	-0.35	Small
SR2	6.64	6.44	-0.20	Small
SR3	6.80	6.41	-0.38	Small
SR4	6.73	6.39	-0.34	Small
SR5 DS	6.39	6.62	0.23	Small
SR5 DM	6.41	6.51	0.10	Imperceptible
SR6	6.99	6.42	-0.57	Small
SR7 DM	6.57	6.54	-0.03	Imperceptible
SR8 DS	6.49	6.66	0.17	Small
SR9	6.94	6.45	-0.49	Small
SR10 DM	6.85	6.50	-0.35	Small
SR10 DS	6.67	6.53	-0.14	Small
SR11 DM	6.74	6.50	-0.24	Small
SR11 DS	6.59	6.54	-0.05	Imperceptible
SR12	6.53	6.48	-0.05	Imperceptible
SR13	6.59	6.50	-0.10	Imperceptible
SR14	6.53	6.43	-0.10	Imperceptible
SR15	6.54	6.46	-0.08	Imperceptible
SR16	6.59	6.88	0.29	Small
SR17	7.02	7.02	0.00	No Change

6.5.24 All of the worst case receptors, that being the closest residential receptors to the scheme, are not predicted to exceed the AQO for NO_2, PM_{10} and $PM_{2.5}$ both with and without the scheme for the years 2018 and 2022. In accordance with the IAN 170/12v3

the predicted concentrations for NO_2 have been calculated using the LTT projection factors published in Box 2.1 in LAQM TG (09).

6.5.25 In accordance with the IAN 174/13 the impact of the scheme on concentrations of both NO_2, PM_{10} and $PM_{2.5}$ is assessed as being not significant as no new exceedances or worsening of existing exceedances of the relevant air quality objectives are predicted.

Construction impacts on Local air quality

6.5.26 At the time of writing, detailed traffic flows for the construction phase are not known. However as highlighted in Table 6.20 it is expected there will be 10-50 HDV (>3.5t) outward movements, in addition to this it is likely there will also be additional movements of vehicles <3.5t during construction, though the number is not known. According to DMRB HA 207/07 a change in flow of HGV movements greater than 200 and/or a change in daily traffic flows of 1000 vehicles can be considered an affected road. The construction phase will not result in an increase in vehicle movements at or above these thresholds and as such any impact on local air quality would be imperceptible.

Regional air quality

6.5.27 In the interest of completeness all of the road links falling within the scheme area were assessed for the Do-Minimum and Do-Something scenarios for the years 2018 and 2022. The results are detailed below in Table 6.27 and Table 6.28.

6.5.28 A comparison is also made between the predicted change in emission associated with the scheme and the total road transport emissions in the North Ayrshire region in 2013.

Table 6.27: Regional Emissions Do-Minimum and Do-Something 2018

Year/Scenario	Total Emissions for all Links		
	NO_X as NO_2 tonnes/year	**PM_{10} tonnes/year**	**CO_2 tonnes/year**
2015 Baseline	6.8	0.17	3138
2018 Do-Minimum	8.2	0.228	3894
2018 Do-Something	8.6	0.229	3993
Change DM v DS	0.4 (4.8%)	0.001 (0.5%)	99 (2.5%)
2013 Total North Ayrshire Road Transport emissions	496	36	160,390

Year/Scenario	Total Emissions for all Links		
	NO_X as NO_2 tonnes/year	**PM_{10} tonnes/year**	**CO_2 tonnes/year**
Predicted DM v DS change as a % of 2013 North Ayrshire Total	0.08%	0.002%	0.06%

6.5.29 The Do-Something scenario results in an increase in the number of vehicle kilometres travelled that results in a small increase in total emissions of NO_x, PM_{10} and CO_2. As vehicle technology improves and older fleet is replaced with newer fleet it is predicted that emission factors for NO_x and PM_{10} are expected to fall year on year and this is illustrated by the NOX and PM_{10} totals being lower in 2022 than 2018 despite the predicted increase in vehicle movements and associated kilometres travelled. In 2022 the increases in traffic growth results in a larger change between the Do-Minimum and Do-Something emissions for PM_{10} but the Do-Something scenario will see the same annual contribution of PM_{10} as the 2018 Do-Minimum and at 11.1kg for the entire year is an imperceptible change.

6.5.30 In the case of CO_2 emissions any predicted improvements in vehicle technology are outweighed by the predicted increase in traffic and also the increase in distance travelled, though when considered alongside the road transport emissions for North Ayrshire these increases are considered not significant.

Table 6.28: Regional Emissions Do-Minimum and Do-Something 2022

Year/Scenario	Total Emissions for all Links		
	NO_X as NO_2 tonnes/year	**PM_{10} tonnes/year**	**CO_2 tonnes/year**
2022 Do minimum	7.91	0.217	3,776
2022 Do Something	7.97	0.228	3,927
Change DM v DS	0.61 (0.8%)	0.011 (4.9%)	151 (3.8%)
2013 Total North Ayrshire Road Transport emissions	496	36	160,390
Predicted DM v DS change as a % of 2013 North Ayrshire Total	0.12%	0.03%	0.09%

6.5.31 As detailed the contribution of the existing alignment and the future emissions predicted with both the Do-Minimum and the Do-Something represent a very small percentage of the road transport emissions throughout the North Ayrshire region. The predicted increase from the Do-Minimum to the Do-Something scenario as a percentage of these regional road transport emissions is well below 1% for both 2018 and 2022 and therefore the impact of the scheme on regional emissions of NO_x, PM_{10} and CO_2 is assessed as being imperceptible.

Compliance Risk Assessment

6.5.32 A review of Defra's UK Ambient Air Quality Interactive Map (Ref 6.27) shows that there are no Compliance Risk Road Network links that are relevant to this assessment and in accordance with IAN 175/13 and no further assessment is required.

6.6 Mitigation measures

During construction

6.6.1 The dust impact assessment has demonstrated that the risk of dust soiling without any mitigation is high for earthworks, and medium for construction and trackout. The risk of adverse health effects of PM_{10} for all stages of the construction of the scheme is assessed as being low.

6.6.2 Table 6.29 6.29 outlines the recommended mitigation to avoid significant adverse temporary (construction) impacts on air quality for this site. The mitigation measures will be detailed in a dust management plan.

Table 6.29: Summary dust risk table to define site-specific mitigation

Mitigation measure	Low risk	Medium risk	High risk
Mitigation for all sites			
Communications			
Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.			Required
Display the head or regional office contact			Required

Mitigation measure	Low risk	Medium risk	High risk
information			
Dust management plan			
Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document.			Required
Site Management			
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.			Required
Make the complaints log available to the local authority when asked.			Required
Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.			Required
Monitoring			
Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.			Required
Carry out regular site inspections to monitor			Required

Mitigation measure	Low risk	Medium risk	High risk
compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked			
Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.			Required
Preparing and maintaining the site			
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.			Required
Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.			Required
Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period			Required
Avoid site runoff of water or mud.			Required
Keep site fencing, barriers and scaffolding clean using wet methods.			Required
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.			Required
Cover, seed or fence stockpiles to prevent wind whipping.			Required
Operating vehicle/machinery and sustainable travel			

Mitigation measure	Low risk	Medium risk	High risk
Ensure all vehicles switch off engines when stationary - no idling vehicles.			Required
Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.			Required
Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate)			Required
Operations			
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, eg suitable local exhaust ventilation systems			Required
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate			Required
Use enclosed chutes and conveyors and covered skips.			Required
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.			Required

Mitigation measure	Low risk	Medium risk	High risk
Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.			Required
Waste management			
Avoid bonfires and burning of waste materials.			Required
Measures specific to earthworks			
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.			Required
Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable			Required
Only remove the cover in small areas during work and not all at once			Required
Measures specific to construction			
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.		Required	
Measures specific to track out			
Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.		Required	
Avoid dry sweeping of large areas.		Required	
Ensure vehicles entering and leaving sites		Required	

Mitigation measure	Low risk	Medium risk	High risk
are covered to prevent escape of materials during transport.			
Record all inspections of haul routes and any subsequent action in a site log book.		Required	
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).		Required	
Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.		Required	
Access gates to be located at least 10m from receptors where possible.		Required	

Post construction

6.6.3 No significant impacts have been identified and as such no further mitigation is required in terms of local or regional air quality.

6.7 Residual impacts

Temporary impacts during construction

6.7.1 Construction activities have the potential to affect sensitive receptors and, consequently, mitigation measures are recommended during the construction of the scheme. It is required that a dust management plan that includes a detailed list of site specific mitigation measures is agreed prior to the commencement of the works. With these mitigation measures implemented and monitored the temporary impact of the scheme on air quality will be negligible.

Permanent impacts post construction

6.7.2 The predicted levels for NO_2, PM_{10} and $PM_{2.5}$ (which are related to the human health) are well below the air quality objectives in both the baseline year and the future assessment years of 2018 and 2022. Therefore it is not anticipated there will be any residual impacts

associated with the operational phase of the scheme, this is discussed in more detail in section 6.9.

6.8 Statutory and planning context

6.8.1 Table 6.30 provides a summary of the principle legislation, plan and policy and the relevance to the scheme and indicates whether the scheme achieves the objectives set out in the documents.

Table 6.30: Statutory and planning context

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
European Directive 2008/50/EC on ambient air quality and cleaner air for Europe	Sets legally binding limits for concentrations in outdoor air of major air pollutants that impact public health such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2)	Relevant receptors in proximity to the scheme	Yes
Part IV of the Environment Act 1995	UK air quality strategy sets out the UK's air quality objectives for 10 pollutants	As above	Yes
Environment Protection Act 1990	Section 79 Statutory Nuisance	Nuisance dust associated with construction	Yes- With provision of adequate dust controls
North Ayrshire LDP	*GENERAL POLICY …. (b) Amenity Levels and effects of emissions including smoke, soot, ash, dust and grit or any other environmental pollution; .."*	Nuisance dust associated with construction	Yes- With provision of adequate dust controls
Scottish Planning Policy 2014, paragraph 29	Includes the guiding principles for sustainable development including "avoiding over-development, protecting the amenity of new and existing	Impacts on local and regional air quality	Yes

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	development and considering the implications of development for water, air and soil quality."		

6.9 Limitations

6.9.1 The verification of the model outputs was undertaken using diffusion tube data collected from September 2015 to February 2016, July 2016 and August 2016. Ideally the verification of model outputs should be undertaken using a full year of data. However where this is not possible technical guidance advises that short term data sets are annualised in accordance with Box 3.2 in LAQM TG(09).

6.10 Conclusion

Temporary impacts during construction

6.10.1 The potential adverse impacts of dust soiling and PM_{10} associated with the temporary construction stage have been assessed in accordance with the latest IAQM guidance on the assessment of dust from demolition and construction. This assessment concluded that without any mitigation the risk of adverse effects of PM_{10} on human health is low. The potential adverse impacts of dust soiling on people without mitigation is high for earthworks and medium for construction and track out, though with the mitigation measures detailed in Table 6.29 become negligible to low. Due to the absence of any ecological sites in relevant proximity to the scheme it was assessed that there are no adverse impacts on ecological receptors.

6.10.2 When considered against the DMRB HA205/08 criteria detailed in Table 4.4 in Chapter 4, the significance of the temporary construction impacts of the scheme with mitigation in place are assessed as slight adverse.

Permanent impacts post construction

6.10.3 The predicted levels of NO_2 for 2018 and 2022 are well below the relevant Air Quality Objectives both with and without the scheme.

6.10.4 The predicted levels of PM_{10} for 2018 and 2022 are well below the relevant Air Quality Objectives both with and without the scheme.

6.10.5 The predicted levels of $PM_{2.5}$ for 2018 and 2022 are well below the relevant Air Quality Objectives both with and without the scheme.

6.10.6 It is assessed that the scheme will not result in a breach or a significant worsening of a breach of the air quality objective for NO_2, PM_{10} or $PM_{2.5}$.

6.10.7 In accordance with the IAN 174/13 the predicted changes, that being the magnitude of change in the concentration levels for both NO_2, PM_{10},and $PM_{2.5}$ ranges from medium adverse to large beneficial, though as detailed above all of the predicted concentrations of both pollutants are well below the respective air quality objectives. Therefore the magnitude of these changes are assessed as being negligible in accordance with the criteria in the DMRB HA205/08 as summarised in Table 4.3 of Chapter 4 of this report.

6.10.8 The construction phase will not result in a significant increase in daily vehicle movements and it is likely that there will be an imperceptible impact on local levels of NO_2, PM_{10} and $PM_{2.5}$.

6.10.9 There are no compliance risk roads that will be impacted on by the scheme and therefore there is no risk of non-compliance with the EU Directive on Ambient Air Quality.

6.10.10 The new alignment of the scheme does result in a small increase in the annual emissions of NO_X, PM_{10} and CO_2. However when considered against the regional road transport emissions for the North Ayrshire region these changes are assessed as being imperceptible and therefore the impact of the scheme on regional air quality is assessed as being negligible in accordance with the criteria in the DMRB HA205/08 as summarised in Table 4.3 of Chapter 4 of this report.

6.10.11 In coming to an overall judgement of significance, the impacts on public exposure, designated sites and the results of the compliance risk rating must be taken into account. As discussed there are no compliance risk roads that will be impacted on by this scheme and there are no designated sites within relevant proximity. The concentrations for NO_2, PM_{10} and $PM_{2.5}$ have been modelled at 17 worst case receptors and it is predicted there will be no exceedance of the air quality objectives for either pollutant. For both the years 2018 and 2022 the majority of the receptors will see an imperceptible to medium benefit to ambient concentrations of NO_2, PM_{10} and $PM_{2.5}$. Of the adverse impacts predicted for all pollutants and scenarios, none will be greater than small. All of the predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ are well below the air quality objectives both with and without the scheme. The scheme will result in small increases

to the regional emissions but as discussed these changes are so small as to be considered imperceptible.

6.10.12 As discussed the local concentrations of NO_2, PM_{10} and $PM_{2.5}$ are predicted to improve at the majority of the worst case residential receptors considered, there is predicted to be an imperceptible impact on regional air quality and there is an absence of any compliance risk roads in the scheme area. When taken as whole and assessed against the DMRB HA205/08 criteria detailed in Chapter 4, the significance of the permanent operational impacts of the scheme on air quality are assessed as slight beneficial.

6.10.13 Statistical analyses of the model performance showed that the model predicted total NO_2 well at most diffusion tube locations without any adjustment. However, the decision was taken to utilise monitoring data to validate the model because the model performed poorly at one location (diffusion tube H). Annualised monitoring data collected in the periods September 2015 – February 2016 and July – August 2016 were used to correct the dispersion model predictions. Statistical analyses of the model performance after adjustment, shown in Appendix 6.2, shows that the model has performed well and that the results for all pollutants and scenarios can be treated with confidence.

7 Cultural Heritage

7.1 Introduction

7.1.1 This chapter provides the likely impacts to cultural heritage arising from the construction and operation of the scheme. The simple assessment has been prepared in accordance with the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 2 (HA208/07) "Cultural Heritage" 2007 (Ref 7.1). The DMRB (HA208/07, chapter 2) identifies and defines three categories of cultural heritage as follows:

- Archaeological remains are the materials created or modified by past human activities that contribute to the study and understanding of past human societies and behaviour.
- Historic buildings are architectural or designed or other structures with a significant historical value.
- Historic landscapes are defined by perceptions that emphasise the evidence of the past and its significance in shaping the present landscape.

7.1.2 This chapter identifies and assesses potential impacts on known and potential cultural heritage receptors. The objective of this assessment is to identify permanent and temporary impacts of the scheme upon cultural heritage and to propose measures to mitigate potentially adverse impacts. Features of cultural heritage may sometimes overlap into multiple sub-categories, however, the DMRB recommends that only the single most suitable category be used for each receptor, and they should only be "double counted" in exceptional circumstances, where the most suitable category has insufficient scope to cover the entire cultural heritage interest of the site (HA208/07, chapter 2, paragraph 2.22).

7.2 Methodology

Determination of baseline

Study area

7.2.1 The DMRB guidelines (HA208/07, Annex 5, paragraph 5.4.1) state that schemes with identified route options should have a study area comprised of the scheme options and any new land-take, plus an area extending at least 200m from either side of them, and that issues of setting may need the consideration of visual or aural envelope of

monuments or even more distant aspects of the assets' surroundings. The study area is defined by a 200m radius in all directions from the centreline of the footprint of the scheme, however this was extended to 300m to consider the visual envelope for listed buildings close to the scheme. Baseline information was gathered through desk study in addition to a walkover survey and consultations with HES and local planning authority heritage officers at WoSAS on behalf of NAC.

Desk study

7.2.2 The following sources of information were used to gather cultural heritage resource data:

- Cultural heritage data recorded in the National Monuments Record of Scotland (NMRS), previously compiled by the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) and now held by HES (Ref 7.2)
- Historic Environment Records (HERs) held by the WoSAS (Ref 7.3)
- HES Historic Land-use Assessment (HLA) map as created by RCAHMS and now held by HES (Ref 7.4)
- Historic maps including Ordnance Survey and pre-Ordnance Survey mapping as held by the National Library of Scotland (Ref 7.5)
- The journal "Discovery and Excavation in Scotland" (Ref 7.6)
- Mapping of known cultural heritage as displayed on the PastMap website (Ref 7.7)
- Mapping of cultural heritage as displayed at the MAGIC Multi Agency Geographic Information for the Countryside website (Ref 7.8)

Walkover survey

7.2.3 A walkover survey to ascertain the locations and extents of known cultural heritage assets within the footprint of the scheme was undertaken in January 2016.

Consultation

7.2.4 At the Stage 2 EIA for this scheme no significant impact was noted by these organisations:

- HES
- WoSAS
- Beith Cultural and Heritage Society (BCHS)

- Friends of Spiers (FoS)

7.2.5 In accordance with the DMRB guidelines for scoping (HA208/07, Annex 8, paragraphs 8.25 to 8.28 and 8.32), consultations were sought on 15 December 2015 from HES, WoSAS, BCHS and FoS with regard to concerns about cultural heritage. The consultations and responses are summarised in Chapter 5. In particular, HES confirmed there are no Scheduled Monuments, World Heritage Sites, Gardens and Designed Landscapes or Registered Battlefields within the proposed development area or its vicinity, and consequently HES is content that significant impacts to these types of heritage features arising from the scheme are unlikely. WoSAS responded that there is a high likelihood of sub-surface archaeological deposits in areas where the scheme would be constructed, and advised that a programme of archaeological works would be required to assess whether buried archaeological remains are present within these areas. This has been brought forward into mitigation as set out in section 7.5. No further response was forthcoming from BCHS and FoS at the time of writing this assessment.

Statutory and planning review

7.2.6 A desktop review of current legislation, planning policy and technical guidance was carried out between 7 December 2015 and 11 December 2015 to identify all relevant information to the project in relation to cultural heritage. The following online resources were used:

- Chartered Institute for Archaeologists (CIfA) (www.archaeologists.net/codes/ifa) (Ref 7.9)
- Historic Environment Scotland (HES) (www.historic-scotland.gov.uk) (Ref 7.10)
- North Ayrshire Council (NAC) (www.north-ayrshire.gov.uk/resident/planning-and-building-standards/planning-and-building-standards.aspx) (Ref 7.11)
- The Scottish Government (www.gov.scot) (Ref 7.12)
- UK legislation (www.legislation.gov.uk) (Ref 7.13)
- West of Scotland Archaeology Service (WoSAS) (www.wosas.net/about.html) (Ref 7.14)

Assessment of impact

Determination of baseline sensitivity

7.2.7 This assessment is based on guidelines set out by the DMRB (HA208/7, Annex 5, paragraph 5.10; Annex 6, paragraph 6.10; and Annex 7, paragraph 7.10) to analyse the sensitivity of designated and undesignated cultural heritage receptors. This is done by considering the quality and understanding of each receptor, as set out by international, national, and local community legislation, priorities, and frameworks, and by using professional judgement.

7.2.8 As discussed in the DMRB (HA208/7, Annex 5, paragraph 5.10.8), the sensitivity of a cultural heritage receptor may sometimes only be determined as unknown. This often occurs for projects where works fall within areas where previous archaeological investigations have not taken place or have been too limited to provide a clear picture of archaeological activity in the area. Following DMRB guidance about potential archaeological remains of unknown sensitivity (HA208/7, Annex 5, paragraph 5.10.8), an estimate of the risk of impact will be given and a plan of mitigation presented to ensure the scheme complies with legislative and planning policy. Table 7.1 identifies the criteria as outlined by the DMRB (HA208/07, Annex 5, Table 5.1; Annex 6, Table 6.1; and Annex 7, Table 7.1) that is used in this assessment to determine the sensitivity of a cultural heritage receptor.

7.2.9 As set out by the DMRB (HA208/7, Annex 5, paragraph 5.10; Annex 6, paragraph 6.10; Annex 7, paragraph 7.10), an analysis of the impacts on cultural heritage must include an assessment of the sensitivity of each location, including their settings along with the magnitude of impact. The DMRB guidance (HA208/07, chapter 4, paragraph 4.19) states the settings of cultural heritage receptors are part of their intrinsic values, and defines settings as the surroundings in which places are experienced, while embracing an understanding of perceptible evidence of the past in the present landscape.

7.2.10 Historic Scotland (now HES) Managing Change Guidance Notes on historic environment settings defines setting as the surroundings of cultural heritage that contribute to how it is experienced, understood and appreciated (Ref 7.15). It further notes that though the setting of each receptor will vary, in general it may include the current landscape or town context, the visual envelope incorporating views from and across to a receptor, the character of the surrounding landscape, and other factors such as historical, artistic, literary, linguistic and scenic associations. Following this guidance, visual envelopes as

defined in Chapter 8 are considered to identify impacts on the setting of cultural heritage receptors. Although a receptor may be impacted by changes to its setting, the assessment of those changes should be considered holistically, without singling out the impacts to individual factors that come together to form the setting. In other words, as the DMRB points out, the receptor must remain the focus of the assessment (HA208/07, chapter 4, paragraph 4.21).

Table 7.1: Sensitivity of cultural heritage

Sensitivity	Description	Criteria
Very high	Internationally important, usually legally protected but may also be non-designated	World Heritage Sites (including nominated sites), sites of acknowledged international importance, sites that can contribute significantly to international research objectives, buildings of recognised international importance, historic designated and non-designated landscapes of international value, extremely well-preserved historic landscapes with exceptional coherence, time-depth or other critical factors
High	Nationally important, both legally protected and non-designated	Properties in Care and Scheduled Monuments (including proposed sites), undesignated archaeological remains of schedulable quality and importance, archaeological remains that contribute significantly to acknowledged national research objectives, Category A listed buildings, other listed buildings with exceptional qualities in their fabric or historical associations not adequately reflected in the listing grade, conservation areas containing very important buildings, undesignated structures of clear national importance, designated and non-designated landscapes of high quality and outstanding historic interest or national interest, well-preserved historic landscapes with considerable coherence, time-depth or other critical factors
Medium	Regionally important, not legally protected, of a well-defined extent, nature, date and significance	Designed or undesignated archaeological remains that contribute to regional research objectives, Category B listed buildings, conservation areas containing buildings that contribute significantly to its historic character, historic townscape or built-up areas with important historic integrity in their buildings or built settings, landscapes of average preservation, designated special historic landscapes, undesignated historic landscapes that would justify special historic landscape designation, landscapes of

Sensitivity	Description	Criteria
		regional value, averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factors
Low	Locally important, of low or minor importance	Field systems, ridge and furrow, Category C listed buildings, historic unlisted buildings of modest quality in their fabric or historical association, historic townscape or built-up areas of limited historic integrity in their buildings or built settings, industrial heritage sites, robust undesignated historic landscapes, historic landscapes with importance to local interest groups, historic landscapes whose value is limited by poor preservation
Negligible	Has little or surviving archaeological or historical interest, or where remains have been previously destroyed	Modern field boundaries, drains and ponds, Buildings of no architectural or historical note, buildings of an intrusive character, landscapes with little or no significant historical interest
Unknown	Assets whose archaeological or historical importance is unknown, sites of uncertain character or date	Single find spots, unexcavated features identified as having archaeological or historical potential, such as those existing as crop-marks on aerial photographs, buildings with some hidden (i.e. inaccessible) potential for historic significance

Determination of impact magnitude

7.2.11 The DMRB (HA208/07, chapter 4, paragraph 4.1) defines impacts as changes to the baseline cultural heritage receptors that arise from the scheme. Impacts can be positive, negative; direct, indirect, secondary; short-, medium- or long-term; temporary or permanent, and cumulative. Impacts may affect cultural heritage materially or their settings. The sources of impacts most relevant to this scheme are described and listed in Table 7.2, which is derived from consideration of the DMRB guidelines (HA 208/07, Annex 5, Table 5.2; Annex 6, Table 6.2; and Annex 7, Table 7.2).

Table 7.2: Sources of impacts

Stage/activity	Impacts: negative	Impacts: positive
Ground investigations: trial pits; boreholes	• Removal of archaeological deposits (loss, damage)	
Site clearance: Removal of trees and vegetation; fencing; traffic movement	• Removal of archaeological deposits (loss, damage) • Impact on setting • Change to historic landscape integrity • Intrusion of inappropriate landscape elements	• Re-establishment of historic landscape pattern
Road construction: topsoil removal; excavations for demolition, drainage, shallow foundations, and borrow pits; decontamination; construction traffic movement; siting of construction sites; piling; chemical decontamination; drainage and recharge; landscaping; earth-mounding; spoil disposal; pollution; structures installations; installation of lighting; road alignments; planting	• Dust damage to historic monuments and buildings • Removal of archaeological deposits (loss, damage) • Vibration from piling: damage to historic structures • Disturbance of historic land use pattern • Visual or aural intrusions • Disruption of historic landscape integrity • Desiccation of waterlogged archaeological deposits • Change of chemical conditions/regime to waterlogged archaeological deposits • Collision damage to upstanding monuments/buildings from construction traffic • Damage through rutting of superficial deposits • Compaction of archaeological deposits • Damage caused by changes to hydrology and	• Screening improving setting • Removal of traffic from sensitive areas • Screening of receptors • Re-establishment of historic landscape pattern

Stage/activity	Impacts: negative	Impacts: positive
	chemical alteration • Vibration causing damage to historic monuments and buildings • Damage to receptors by pollution • Removal of archaeological deposits through topsoil stripping for storage areas • Severance causing dereliction or neglect of receptors or reduction of group value • Damage to archaeological deposits through vegetation root action	
Operational: maintenance of drainage ditches and lighting; traffic movement; general site maintenance; planting	• Removal of archaeological deposits (loss, damage) • Damage to receptors due to maintenance • Damage to receptors by pollutants • Impact on settings of receptors • Small scale repairs, consolidation or alteration of historic landscape elements constitute a cumulative impact	• Arrest of erosion or deterioration • Re-establishment of historic landscape elements • Improvement of lighting ambience • Re-establishment of historic landscape pattern
Other environmental mitigation (not exhaustive): ecological pond creation; landscape planting; other screening; noise reduction panelling; noise reduction glazing	• Removal of archaeological deposits (loss, damage) • Impact on setting of receptors • Damage to historic landscape elements • Visual intrusion to the historic landscape	• Screening of receptors • Re-establishment of historic landscape pattern

7.2.12 The magnitude of impact for each cultural heritage receptor is given in Table 7.3, which is derived from the DMRB (HA208/07, Annex 5, Table 5.3; Annex 6, Table 6.3; and Annex 7, Table 7.3). The magnitude of impact for each cultural heritage receptor is judged without considering sensitivity, so that the total destruction of a receptor with low sensitivity has the same magnitude of impact as the total destruction of a highly sensitive receptor. The judgement of magnitude of impact is based on the principle that physical preservation is preferred, as the worst impact to archaeological remains, historical buildings and historic landscapes is usually the complete physical destruction of the receptor.

Table 7.3: Magnitude of impact

Magnitude of impact	Description
Major	• Change to most or all key archaeological materials, historic building elements such that the resource is totally altered • Comprehensive changes to settings of cultural heritage receptors • Change to most or all key historic landscape elements, parcels or components resulting in total change to historic landscape character unit, including: extreme visual changes; gross change of noise or change to sound quality; or fundamental changes to use or access
Moderate	• Changes to many key archaeological materials, historic building elements such that the receptor is clearly modified • Considerable changes or modifications to the setting that affect the character of the receptor • Changes to many key historic landscape elements, parcels or components resulting in moderate changes to historic landscape character, including: visual change to many key aspects of the historic landscape; noticeable differences in noise or sound quality; or considerable changes to use or access
Minor	• Changes to key archaeological materials, historic building elements such that the receptor is slightly altered or made slightly different • Slight changes to setting, such that it is noticeably changed • Changes to few key historic landscape elements, parcels or components resulting in limited changes to historic landscape character, including: slight visual changes to few key aspects of

Magnitude of impact	Description
	historic landscape; limited changes to noise levels or sound quality; or slight changes to use or access
Negligible	• Very minor changes to archaeological materials, historic building elements or setting • Very minor changes to key historic landscape elements, parcels or components resulting in a very small change to historic landscape character, including: virtually unchanged visual changes; very slight changes in noise levels or sound quality; or very slight changes to use or access
No change	• No change to archaeological remains • No change to fabric or setting of historic building elements • No change to elements, parcels or components; no visual or audible changes; no changes arising from in amenity or community factors

Impact significance

7.2.13 Following guidance from the DMRB (HA208/07, Annex 5, Table 5.13; Annex 6, Table 6.13; and Annex 7, Table 7.13), the significance of the impacts of the scheme is a combination of the value of the cultural heritage receptor and the magnitude of the impact for each cultural heritage receptor affected. As suggested by the DMRB, the judgements expressed in the report are checked through the significance matrix, which is shown in Table 4.4. However, the assessment of the significance of impact is not solely dictated by the results of the matrix check; professional judgement is used to ensure that the value assigned to each receptor, the magnitude of impact defined for each receptor, and the results of the analysis of the significance of impacts are all balanced. Therefore, the scales of value, impact and significance will be similar across assessed archaeological remains, historic buildings, and historic landscapes, so that the impacts of the scheme on each receptor may be compared to each other.

7.3 Baseline conditions

7.3.1 The area surrounding the scheme is occupied partly by agricultural land, and partly by the town of Beith itself. At 500ft, Beith (from the Gaelic for 'birch') is the highest town in Ayrshire, and was once known as Hill of Beith. From the 18th century to the mid-20th

century Beith was the most important furniture manufacturing town in Scotland, with a reputation of high quality produce; it was also involved in cotton spinning, thread making and muslin weaving and had a brewery, distilleries, a tobacco factory and corn mills (Ref 7.16).

7.3.2 The site walkover within the scheme footprint area confirmed that the A737 is an existing transport corridor that has been subject to extensive ground disturbance during its construction and ongoing routine maintenance schemes. This will have truncated if not wholly destroyed archaeological remains within the existing corridor. However the scheme proposes to create fresh ground disturbance in areas surrounding the existing corridor that have never been part of the transport network. These areas are 18th and 19th century improved agricultural lands with evidence of earlier land-use and are currently under plough; the combined years of agricultural activity may have disturbed, but not necessarily destroyed, sub-surface archaeological remains. No unrecorded archaeological remains were visually detected within the scheme footprint area during the site walkover. The listed buildings and historic landscapes within the scheme footprint were visited and this informs the assessment that follows.

7.3.3 The baseline cultural heritage receptors are shown in Figure 7.1. Each cultural heritage receptor is assigned a unique number in its respective table (Table 7.4, Table 7.5, Table 7.6, Table 7.7 and Table 7.8); the purpose of the number is to provide a cross-reference to the location of each cultural heritage receptor as shown in Figures 7.1 Cultural Heritage and 7.2 HLA.

Archaeological remains

7.3.4 There are no World Heritage Sites, Scheduled Monuments or Registered Battlefields recorded within the study area. There are two archaeological sites recorded in Canmore within the study area, both of which are findspots of a perforated stone and a spindle whorl, respectively. There is also a Canmore entry for the Beith Bypass itself. Further details for each of these sites including the distances in meters from the centreline of the scheme footprint are given in Table 7.4.

Table 7.4: Archaeological sites and receptors within 300m of scheme

No.	Category	HES Ref.	Distance (m) from centreline of scheme footprint
1	Find – perforated stone	NS35SE 3	195
2	Beith Bypass	NS35SE 75	1
3	Find – spindle whorl	NS35SE 4	296

7.3.5 It should be borne in mind that there may be significant unrecorded archaeological remains within the study area (see section 7.3.11).

Listed and historic buildings and conservation areas

7.3.6 Listed buildings are categorised by HES as follows:

- Category A buildings are of national or international importance, either architectural or historic, or fine little-altered examples of some particular period, style or building type. The study area contains no Category A buildings.
- Category B buildings are of regional or more than local importance, or major examples of some particular period, style or building type that may have been altered. There are seven Category B buildings within the study area.
- Category C buildings are of local importance, may be lesser examples of any period, style, or building type, as originally constructed or moderately altered, and include simple traditional buildings that group well with other listed buildings. There are five Category C buildings within the study area.

7.3.7 According to HES, there are 109 listed buildings and structures located within the old parish boundary of Beith, 72 of which are within the town of Beith. Of all of these, only 12 listed buildings and structures fall within the 300m study area and these are listed in Table 7.5.

Table 7.5: Listed Buildings within 300m of the scheme

No.	Listing Name	Cat.	HES Ref and Site Number	Distance (m) from centreline of scheme footprint
4	2 and 2a Barrmill Road, Knockbuckle and Knockbuckle Cottage, including boundary walls and gatepiers	B	LB938 NS35SW 119	216
5	Bigholm Road, Hamilfield, including walled garden and boundary walls	B	LB881 NS35SE 57	197
6	Geilsland Road, Geilsland Church Of Scotland School	B	LB901 NS35SE 63	129
7	65 Wilson Street, Barrington House, including former coachhouse, boundary walls, gatepiers and gates	B	LB9743 NS35SE 96.1	257
8	4 Barrmill Road, Taynish, including boundary walls, railings and gatepiers	B	LB939 NS35SW 120	197
9	Head Street, Former United Free Church, including boundary walls, railings, gates and gatepiers	B	LB898 NS35SE 50	117
10	Kirk Road, High Church, including boundary walls, gatepiers and gates	B	LB923 NS35SW 58	287
11	Wilson Street, Beith Trinity Church (Church Of Scotland), including hall, boundary walls, railings and gatepiers	C	LB942 NS35SE 56	204
12	35a Wilson Street, Newton House	C	LB117 NS35SE 53	300

No.	Listing Name	Cat.	HES Ref and Site Number	Distance (m) from centreline of scheme footprint
13	63 Wilson Street, Dunlop Cottage, including boundary walls	C	LB49742 NS35SE 94	249
14	Barrmill Road, gatepiers, railings and boundary walls to former Spier's School	C	LB49727 NS35SE 51.1	6
15	31 Head Street, including former byre to rear	C	LB49737 NS35SE 93	208

7.3.8 The details of 18 further cultural heritage receptors, all of which are non-designated, are within the study area as recorded by Canmore. These are presented in Table 7.6, including 16 historic buildings (sites 16-24, 27-29, 31-33), a public garden at Wilson Street (site 25), and the grounds of Spier's School (site 30). The latter two sites are made accessible to the public and maintained by NAC.

Table 7.6: Cultural heritage receptors within 300m of the scheme

No.	Site	HES Ref	Distance (m) from centreline of scheme footprint
16	Head Street, bakery and garage	NS35SE 80	279
17	Craighouse	NS35SE 67	285
18	Crummock	NS35SE 74	44
19	Crummock House	NS35SE 24	110
20	39 Wilson Street	NS35SW 94	296
21	51 Wilson Street	NS35SE 58	278
22	41 Wilson Street	NS35SE 55	290
23	3 Roebank Road, Manse	NS35SE 71	292
24	Bigholm Road, Grangevale	NS35SE 72	118
25	Wilson Street, public garden	NS35SE 89	253
26	Crummock Street, Drill Hall	NS35SE 106	265

No.	Site	HES Ref	Distance (m) from centreline of scheme footprint
27	West Of Scotland Cabinet Works	NS35SW 23	149
28	44 Glebe Road	NS35SW 201	34
29	38 Glebe Road	NS35SW 212	51
30	Spier's School (grounds of)	NS35SE 51	123
31	Hill Of Beith	NS35SE 2	274
32	Kirk Road, Church Hall	NS35SW 58.1	285
33	A737, garage	NS35SE 84	19

7.3.9 A conservation area (site 34) has been designated in the historic landscape of Beith town centre from Eglinton Street, Main Street and the north end of Barrmill Road, and is detailed in Table 7.7.

Table 7.7: Conservation areas

No.	Site	Distance (m) from centreline of scheme footprint
34	Beith town centre	312

Historic landscapes

7.3.10 There are no Gardens and Designed Landscapes or World Heritage Sites recorded within the study area. Historic Land-use Assessment (HLA) is the digitally recorded land use across Scotland as mapped by HES (Ref 7.4). The HLA dataset records the historical and current land use into types that are defined by the kinds of use the land has experienced; for example urbanisation may occur on land that previously was a post-medieval field system, and prior to that use had been a prehistoric ritual and funerary area. Each of these uses is present in the HLA and creates a record of land use across time for a given location in Scotland. The HLA types recorded by HES within 300m of the scheme footprint are detailed in Table 7.8 and shown in Figure 7.2 HLA. There is no land-use type recorded within the study area predating the medieval period. The earliest land-use type is a small area bordering the southern side of the A737 between Barrmill Road and Manrahead Roundabout, centred on NS 34591 53156 (site 40); this area is recorded as containing medieval or post-medieval remains of settlements and field

systems that may include ruined buildings, small kilns, curvilinear boundaries and rig cultivation. By the 17th century AD onwards, area 40 and the vast majority of the countryside surrounding the town of Beith (area 41) became rectilinear fields and boundaries associated with buildings and agricultural improvements typical of 17th and 18th centuries. The areas around Spier's School (area 37) and to north of the scheme, near Grangehill (area 39), are designed landscapes typical of the 17th century onwards that once contained formal landscaping, gardens, parkland and woodlands, however these are not included in the Inventory of Gardens and Designed Landscapes compiled and maintained by HES. The urban areas (areas 35 and 36) relate to the growth of the town of Beith from the 18th century to the mid-20th century.

Table 7.8: HLA areas

No.	HLA type	Distance (m) from centreline of scheme footprint
35	Urban area, west of A737	0
36	Urban area, east of A737, within Geilsland School area	138
37	Designed landscape[1], between Geilsland Road and Barrmill Road	0
38	Recreation area, between Geilsland Road and Wardrop Street	0
39	Designed landscape[1], near Grangehill	150
40	Medieval/post-medieval settlement and agriculture, centred on NS 34591 53156	0
41	Rectilinear fields and farms, found in most of the surrounding areas around Beith	0
1 Not included in the Inventory of Gardens and Designed Landscapes compiled and maintained by HES		

Unrecorded archaeological remains

7.3.11 Unknown buried archaeological remains have been uncovered at many sites proposed for development, and there is the potential for unrecorded features and artefacts to be present within the scheme footprint. The areas where the risk is considered to be highest are shown in Figures 7.1 Cultural Heritage and 7.2 HLA. Potential archaeological

remains in these areas may be disturbed, damaged or destroyed by the scheme. Following DMRB guidance (HA208/7, Annex 5, paragraph 5.10.8) a plan of mitigation is presented in section 7.5 to reduce risk to the scheme and to comply with legislative and local planning policies in the event that potential buried archaeological features exist within the scheme footprint area.

Scope of assessment

7.3.12 A number of the archaeological features described in the baseline are outwith the 200m study area recommended by DMRB (HA208/7, Annex 5, paragraph 5.4.1). Similarly, a number of the listed and historic buildings are out with the visual envelope that is defined in Chapter 8 Landscape Effects. Accordingly, these cultural heritage receptors are unlikely to be affected by the scheme and do not need to be considered in this Stage 3 assessment. The Stage 2 EIA concluded, in consultation with HES, WoSAS, BCHS and FoS, that no significant impacts were considered likely. In view of this the following paragraphs and Tables 7.9 and 7.10 identify the historic environment assets that could be affected by the scheme and are subject to a simple assessment.

Archaeological remains

7.3.13 Following guidance from the DMRB (HA208/07, Annex 5, paragraph 5.4), the study area for the assessment of archaeological remains is reduced to 200m. Therefore the spindle whorl find spot (site 3) is not considered further because it is 296m away from the scheme, and there will be no direct or indirect impacts from the scheme upon that location. The perforated stone find spot (site 1) falls just within the 200m study at 195m, however after considering the scheme and its extents in relation to this location, it is determined that the scheme is at a sufficient distance to exclude the possibility of direct or indirect impact on the find spot. The current A737 (site 2 and site 33) are not included in the simple assessment for the following reasons: the Canmore records refers to three drawings that are associated with events that occurred on Bypass Road. This includes the survey of the proposal for the bypass in 1928, the building of a proposed factory in 1956, and the plans for adding a garage to an existing repair shop in 1965. While these events are part of the history of Bypass Road, the events themselves are not affected by the scheme.

Listed and historic buildings and conservation areas

7.3.14 In accordance with the DMRB (HA208/07, Annex 6, paragraph 6.4), the assessment of impacts on historic buildings and conservation areas is restricted to locations within the

visual envelope of the scheme as described in Chapter 8 Landscape Effects (sections 8.4.25, 8.4.29, 8.4.64, and 8.4.24); other factors under consideration include the each potential receptor's proximity to the scheme footprint and the likelihood that the scheme might have a direct or indirect impact upon it. Therefore, the following locations outside of the visual envelope of the scheme are not included in the simple assessment: sites 4, 5, 7 to 13, 15 to 17, 19 to 29, 31, 32 and 34.

7.3.15 The record in Canmore for the garage (site 33) relates to plans for adding a garage to a repair shop in 1965 that were recorded in a survey drawing. The current garage is a modern BP petrol-refilling facility with a convenience shop, automobile repair centre, and with a hot foam hand car wash. Considering the discussion of the visual envelope at the garage in Chapter 8 and following the site visit, the garage is seen to correspond closely to the nature and setting of the transport corridor that it serves and has very limited cultural heritage sensitivity; it is therefore not included in the simple assessment.

7.3.16 The Geilsland Church of Scotland School (site 6) is a Category C listed building and the gatepiers, railings and boundary walls of the former Spier's School (site 14) is a Category B listed building. The farmhouse at Crummock (site 18) is an undesignated historical building dating from the 19th century that appears on the 1858 Ayr sheet VIII.6 (Beith) Ordnance Survey 1st edition 25 inch to the mile series (Ref 7.18). The Canmore record (NS35SE 74) gives no information on the history of the farmstead itself, but notes that HES holds a drawing in its collection of the building from c.1955 by architect James Houston of Kilbirnie who completed plans, sections and elevations for the construction of a new byre at Crummock for Major Bryce Knox. These three locations are within the visual envelope as defined in Chapter 8 Landscape Effects and presented in Figures 7.1 and 7.2 and are included in the simple assessment.

Historic landscapes

7.3.17 This section takes into account the scale and likely effects of the scheme on historic landscapes following guidance from the DMRB (HA208/07, Annex 7, paragraph 7.4). The urban areas recorded in the HLA database (areas 35 and 36) refer to land that has seen extensive excavation and construction works as a result of urbanisation. Area 35 is the town of Beith itself, as it presents immediately west of the A737, and as the scheme works will not intrude upon the historical or cultural heritage character found within this area, it is scoped out of further assessment. The Geilsland School extents contains two HLA areas identified as urban land (area 36) and a recreational area (area 38); the urbanised area refers to the modern buildings, car park facilities and paved drives that

comprise the school grounds, while the recreational grounds refer to the grass playing field bordering Wardrop Street to the north of the school buildings. These strongly contribute to the character of that area, which includes the listed school building (site 6) already included in the simple assessment, therefore these landscapes will also be included in the simple assessment. The non-designated designed landscape of the former Spier's School (area 37) and the surrounding grounds of the school (site 30) are small historic landscapes with recreational value that are maintained and made accessible to the public by NAC, including a formal landscape with a walled garden, woodland, ornamental plantings, and grazing land. These strongly relate to the listed structure at the same location (site 14), and are thus also scoped into the simple assessment. The designed landscape near Grangehill (area 39) is sufficiently far enough away from the scheme (150m) that is unlikely to be affected directly or indirectly by it.

7.3.18 There are two HLA areas (areas 40 and 41) with potential archaeological remains. Area 40 comprises the medieval/post-medieval settlement and agricultural area that is recorded between Barrmill Road and Manrahead Roundabout; this later became part of rectilinear fields and farms of the 18th and 19th centuries, which now dominate the land underlying and surrounding the scheme to the east (area 41). The lack of extensive agricultural, industrial or urban development in these locations indicates there is a risk that buried archaeological remains from the medieval or post-medieval period may be present that would be damaged or destroyed by the scheme. Area 40 is defined by HES (Ref 7.17) as encompassing a wide range of structures, including farm buildings, small milles, grain-drying kilns, curvilinear field boundaries, tiny enclosures called 'planticrubs', head dykes and broad, curving ridge and furrow cultivation. The site walkover within the scheme footprint revealed no features; the fields have been ploughed flat. Nevertheless, as these areas underlie the scheme footprint and potentially contain archaeological remains, they are therefore included in the simple assessment.

Table 7.9: Cultural heritage assets not included in the simple assessment

No.	Cultural heritage	Canmore or HES reference
1	Find – perforated stone	NS35SE 3
2	Beith, Bypass Road	NS35SE 75
3	Find – spindle whorl	NS35SE 4
4	2 and 2a Barrmill Road, Knockbuckle and Knockbuckle Cottage, including boundary walls and gatepiers, Category B Listed Building	LB938/NS35SW 119
5	Bigholm Road, Hamilfield, including walled garden and boundary walls, Category B Listed Building	LB881/NS35SE 57
7	65 Wilson Street, Barrington House, including former coachhouse, boundary walls, gatepiers and gates, Category B Listed Building	LB9743/NS35SE 96.1
8	4 Barrmill Road, Taynish, including boundary walls, railings and gatepiers, Category B Listed Building	LB939/NS35SW 120
9	Head Street, Former United Free Church, including boundary walls, railings, gates and gatepiers, Category B Listed Building	LB898/NS35SE 50
10	Kirk Road, High Church, including boundary walls, gatepiers and gates, Category B Listed Building	LB923/NS35SW 58
11	Wilson Street, Beith Trinity Church (Church Of Scotland), including hall, boundary walls, railings and gatepiers, Category C Listed Building	LB942/NS35SE 56
12	35a Wilson Street, Newton House, Category C Listed Building	LB117/NS35SE 53
13	63 Wilson Street, Dunlop Cottage, including boundary walls, Category C Listed Building	LB49742/NS35SE 94
15	31 Head Street, including former byre to rear, Category C Listed Building	LB49737/NS35SE 93

No.	Cultural heritage	Canmore or HES reference
16	Head Street, bakery and garage	NS35SE 80
17	Craighouse	NS35SE 67
19	Crummock House	NS35SE 24
20	39 Wilson Street	NS35SW 94
21	51 Wilson Street	NS35SE 58
22	41 Wilson Street	NS35SE 55
23	3 Roebank Road, Manse	NS35SE 71
24	Bigholm Road, Grangevale	NS35SE 72
25	Wilson Street, public garden	NS35SE 89
26	Crummock Street, Drill Hall	NS35SE 106
27	West Of Scotland Cabinet Works	NS35SW 23
28	44 Glebe Road	NS35SW 201
29	38 Glebe Road	NS35SW 212
31	Hill Of Beith	NS35SE 2
32	Kirk Road, Church Hall	NS35SW 58.1
33	Beith, Bypass Road, Garage	NS35SE 84
34	Beith town centre	N/A
35	Urban area, west of A737	N/A

No.	Cultural heritage	Canmore or HES reference
39	Designed landscape[1], near Grangehill	N/A
1 Not included in the Inventory of Gardens and Designed Landscapes compiled and maintained by HES		

Table 7.10: Cultural heritage assets included in the simple assessment

No.	Cultural heritage receptor	Canmore or HES reference
6	Geilsland Road, Geilsland Church Of Scotland School, Category B Listed Building	LB901/NS35SE 63
14	Barrmill Road, gatepiers, railings and boundary walls to former Spier's School, Category C Listed Building	LB49727 / NS35SE 51.1
18	Crummock	NS35SE 74
30	Spier's School (grounds of)	NS35SE 51
36	Urban area, east of A737, within Geilsland School area	N/A
37	Designed landscape[1], between Geilsland Road and Barrmill Road	N/A
38	Recreation area, between Geilsland Road and Wardrop Street	N/A
40	Medieval/post-medieval settlement and agriculture, centred on NS 34591 53156	N/A
41	Rectilinear fields and farms, found in most of the surrounding areas around Beith	N/A
1 Not included in the Inventory of Gardens and Designed Landscapes compiled and maintained by HES		

Sensitivity of cultural heritage baseline

7.3.19 The value of the cultural heritage baseline and sensitivity to change is set out in Table 7.11 and detailed as follows.

7.3.20 There are no known archaeological sites that are subject to the simple assessment for this scheme. However, as discussed in paragraph 7.3.17 there is potential for archaeological remains to be present within the site footprint at areas 40 and 41, therefore these will now be considered for sensitivity from an archaeological perspective. However, HES notes that when medieval/post-medieval settlement and agricultural areas like area 40 and 41 are excavated and surviving evidence is recovered, it usually dates to the 17th or 18th centuries, with medieval evidence particularly difficult to identify. If the potential archaeological remains in areas 40 and 41 follow this pattern, they are most likely have low sensitivity, as the agricultural activity within the areas has probably been significant enough to truncate or even eradicate features. Nevertheless, under the criteria set out in Table 7.1 it must be concluded that areas 40 and 41 have unknown sensitivity. However, in order to protect potential cultural remains within the scheme footprint, reduce risk to the scheme, and comply with the DMRB (Annex 5, paragraph 5.10.8), mitigation measures without prejudice as to the sensitivity of the potential archaeological remains are set out in section 7.5.

7.3.21 Historic buildings with sensitivity are summarised as follows. In accordance with the criteria set out by the DMRB as reflected in Table 7.1, Geilsland Church of Scotland School (site 6) and the entrance to Spier's School (site 14) are considered to be of low and medium sensitivities, respectively. The farmhouse at Crummock has a low sensitivity because, following guidance from the DMRB (Annex 6, section 6.10) and under the criteria set out in Table 7.1, it is primarily important to the local area and local interest groups as a local historic residential building.

7.3.22 Historic landscapes with sensitivity are summarised as follows. Following guidance from the DMRB (Annex 7, section 7.10) and under the criteria set out in Table 7.1 it is determined that the HLA urban area (area 36) and recreational grounds (area 38) within the Geilsland School area each have low sensitivity because the landscapes have changed significantly in their purpose of use and layout, from being a private residential home to a privately-owned school, which is now closed, and are important to the local area and local interest groups. Similarly, the two sites at the former Spier's School (sites 30 and 37) also have low sensitivity because the grounds have changed significantly in

botanical content, their purpose of use and layout following the demolition of the school buildings in 1972, and are important to the local area and local interest groups.

Table 7.11: Sensitivity of cultural heritage baseline

No.	Cultural heritage receptor	Sensitivity
6	Geilsland Road, Geilsland Church Of Scotland School, Category B Listed Building	Medium
14	Barrmill Road, gatepiers, railings and boundary walls to former Spier's School, Category C Listed Building	Low
18	Crummock	Low
30	Spier's School (grounds of)	Low
36	Urban area, east of the A737, within Geilsland School area	Low
37	Designed landscape[1], between Geilsland Road and Barrmill Road	Low
38	Recreation area, between Geilsland Road and Wardrop Street	Low
40	Medieval/post-medieval settlement and agriculture, centred on NS 34591 53156	Unknown or Low
41	Rectilinear fields and farms, found in most of the surrounding areas around Beith	Unknown or Low
1 Not included in the Inventory of Gardens and Designed Landscapes compiled and maintained by HES		

7.4 Impact assessment

Temporary impacts

7.4.1 The assessment follows the methodology set out in sections 7.2.11 to 7.2.13 to determine the magnitude of temporary impacts on the nine cultural heritage receptors that could be affected by the scheme. The results are summarised in Table 7.12.

7.4.2 Due to the nature of road construction, the scheme will introduce an impact of moderate adverse magnitude during construction to the setting of the Geilsland School complex, affecting the listed school building (site 6), urbanised area (area 36) and its recreational grounds (area 38). As detailed in Chapter 12 Noise and Vibration, the area is relatively quiet and there will be a high level of disturbance during construction near Wardrop

Street which leads to these locations from the northwest and on Geilsland Road from the southwest. This results in an impact of moderate adverse significance on the school building (site 6), and an impact of slight adverse significance on the urban area (site 36) and recreational grounds (area 38).

7.4.3 The scheme will introduce an impact of minor adverse magnitude during construction to the setting of the listed entrance to the former Spier's School (site 14), its old grounds (site 30) and its non-designated designed landscape (area 37) due to the nature of major construction works. As at the Geilsland School complex, this area is also relatively quiet and there will be a high level of disturbance during construction. The properties assessed for noise and vibration impacts in Chapter 12 (paragraphs 12.11.8 to 12.11.12 and Table 12.33) that are closest to sites 14, 30 and 37 include the north and west façades at 45 Barrmill Road and the west façade at 2 Spiersland Way. Chapter 12 concludes that following mitigation the scheme has a short term negligible adverse impact to the north façade of 45 Barrmill Road and a moderate beneficial impact to the east façade of the same property. The property at 2 Spiersland Way is assessed to its west and is expected to have short term minor adverse impact. No trees within the designed landscape (area 37) will be removed. Taking all of the above into account, the scheme therefore has an impact of slight adverse significance on the listed entrance (site 14), the school grounds (site 30) and the designed landscape (area 37).

7.4.4 As discussed in Chapter 8 Landscape Effects (section 8.7.5), the farmhouse at Crummock (site 18) will experience an impact of moderate adverse significance during construction for the following reasons: fencing and temporary works areas will intrude upon the landscape setting of the farmhouse; traffic management will be in place causing restricted access to the A737 and the property; the tranquillity and visual amenity afforded to the setting will be disrupted due to the works taking place, and; plant and artificial site lighting will be present where currently there is none. Therefore, the scheme has an impact of slight adverse significance on the farmhouse.

7.4.5 The scheme will incur significant excavation across two areas that potentially contain buried archaeological remains, including an area of medieval or post-medieval settlement and agriculture (area 40), which falls within the scheme extents between Barrmill Road and Manrahead Roundabout, and the rectilinear fields and farms that dominate the land occupied by the scheme (area 41). However, this aspect is assessed under permanent impacts as it would involve the permanent loss of an asset.

Table 7.12: Temporary impacts

No.	Cultural heritage receptor	Sensitivity	Magnitude of Impact	Significance of Impact
6	Geilsland Road, Geilsland Church Of Scotland School, Category B Listed Building	Medium	Moderate adverse	Moderate adverse
14	Barrmill Road, gatepiers, railings and boundary walls to former Spier's School, Category C Listed Building	Low	Minor adverse	Slight adverse
18	Crummock	Low	Moderate adverse	Slight adverse
30	Spier's School (grounds of)	Low	Minor adverse	Slight adverse
36	Urban area, east of A737, within Geilsland School area	Low	Moderate adverse	Slight adverse
37	Designed landscape[1], between Geilsland Road and Barrmill Road	Low	Minor adverse	Slight adverse
38	Recreation area, between Geilsland Road and Wardrop Street	Low	Moderate adverse	Slight adverse
1 Not included in the Inventory of Gardens and Designed Landscapes compiled and maintained by HES				

Permanent impacts

7.4.6 This assessment follows the methodology set out in sections 7.2.11 to 7.2.13 to determine the relevant permanent impacts and the magnitude of those impacts on the nine cultural heritage receptors that were scoped into the assessment. The results are summarised in Table 7.13.

7.4.7 The scheme will introduce an impact of minor adverse magnitude to the setting of the listed entrance to setting of the Geilsland School complex, affecting the listed school building (site 6), urbanised area (area 36) and its recreational grounds (area 38). As discussed in Chapter 8 Landscape Effects (section 8.7.13), there will be disruption to the

views and tranquillity afforded to the setting due to the removal of landscape features and because the scheme will result in the A737 moving slightly closer to the complex. Therefore, the significance of impact of the scheme on the listed school building (site 6), the urbanised area (area 36) and the recreational grounds (area 38) is slight adverse.

7.4.8 The scheme will introduce an impact of moderate beneficial magnitude to the setting of the listed entrance to the former Spier's School (site 14) and its old grounds (site 30) and an impact of minor adverse magnitude to the setting of the non-designated designed landscape (area 37) for the following reasons. Barrmill Road/B706, which leads to the receptor from the northwest, will no longer be available for use by motorists; instead, it will be converted to a footpath and cycle lane that will go past the listed entrance, improving access to these locations via walking, riding and cycling. The new footpath on the west side of site 37 will also improve access to sites 14, 30 and 37. As discussed in Chapter 8 Landscape Effects (section 8.4.21) this may be considered a beneficial impact to the local community as the walls, gatepiers, school grounds and its designed landscape are vital links to a living history for those who attended the school until its closure in 1972. However, during operation the scheme may lead to increased noise levels in the area. The closest residential receptors assessed in Chapter 12 Noise and Vibration (sections 12.11.8 to 12.11.12 and Table 12.33) are 45 Barrmill Road and 2 Spiersland Way. In the long term and following mitigation the scheme has no significant impact to the north façade and a significant beneficial impact to the east façade of 45 Barrmill Road. Similarly, the scheme is expected in the long term and following mitigation to have no significant impact to the east façade of 2 Spiersland Way. However, the scheme will result in the new road infrastructure being sited much closer to the western side of area 37, which as a result will be impacted by an increase in noise and vibration. During operation, the scheme could also lead to reduced air quality in the area. Chapter 6 Air Quality notes a long term slight decrease in air quality at 45 Barrmill Road and 16 Barrmill Road, which are the closest receptors to sites 14, 30 and 37, but concludes that overall the scheme will not result in a breach or significant worsening of air quality objectives. Taking all of the above into account, it is therefore concluded that the scheme has a slight beneficial significance of impact on the school grounds (site 30) and the listed entrance (site 14), and an impact significance of slight adverse significance on the non-designated designed landscape (area 37).

7.4.9 The scheme will change the setting of the farmhouse at Crummock (site 18) due to the removal of landscape features and because the scheme will result in the A737 being

slightly closer to the farmhouse (see section 8.5.29). This is considered to be an impact of minor adverse magnitude. The scheme therefore has an impact of slight adverse significance on the farmhouse.

7.4.10 A conservative approach has been taken in the assessment of the magnitude of impact to the location of medieval or post-medieval settlement and agriculture (area 40) and the rectilinear fields and farmlands on which the scheme footprint occupies (area 41). The former is within the scheme extents between Barrmill Road and Manrahead Roundabout. Neither has been subject to previous archaeological investigations or industrial or agricultural development. Therefore there is a higher likelihood of preserved archaeological remains at these locations. The assessment concludes in section 7.3.20 that areas 40 and 41 have unknown sensitivity. However, it is possible to consider a worst-case scenario of permanent impact by taking into account the discussion in section 7.3.20, which suggests that the most likely sensitivity of potential archaeological remains at these receptors is low. In such a case, with no mitigation in place, the scheme would have an impact of major adverse magnitude due to the irreparable loss of resource that would occur if early archaeological layers are present, resulting in an impact of moderate adverse significance. However, if archaeological remains are not present, the impact is neutral. In order to protect potential archaeological remains and prevent the scheme from becoming at risk, the scheme will follow guidance from the DMRB (Annex 5, paragraph 5.10.8) and propose mitigation measures in section 7.5 without prejudice as to the possible sensitivity of the potential archaeological remains.

Table 7.13: Permanent impacts

No.	Cultural heritage receptor	Sensitivity	Magnitude of Impact	Significance of Impact
6	Geilsland Road, Geilsland Church Of Scotland School, Category B Listed Building	Medium	Minor adverse	Slight adverse
14	Barrmill Road, gatepiers, railings and boundary walls to former Spier's School, Category C Listed Building	Low	Moderate beneficial	Moderate beneficial
18	Crummock	Low	Minor adverse	Slight adverse

No.	Cultural heritage receptor	Sensitivity	Magnitude of Impact	Significance of Impact
30	Spier's School (grounds of)	Low	Moderate beneficial	Slight beneficial
36	Urban area, east of A737, within Geilsland School area	Low	Minor adverse	Slight adverse
37	Designed landscape[1], between Geilsland Road and Barrmill Road	Low	Minor adverse	Slight adverse
38	Recreation area, between Geilsland Road and Wardrop Street	Low	Minor adverse	Slight adverse
40	Medieval/post-medieval settlement and agriculture, centred on NS 34591 53156	Unknown or Low	Major adverse or No change	Moderate adverse or Neutral
41	Rectilinear fields and farms, found in most of the surrounding areas around Beith	Unknown or Low	Major adverse or No change	Moderate adverse or Neutral
1 Not included in the Inventory of Gardens and Designed Landscapes compiled and maintained by HES				

7.5 Mitigation measures

7.5.1 All site operatives will be made aware of cultural heritage receptors during the site induction, especially the location of possible medieval or post-medieval settlement and agricultural remains (area 40) between Barrmill Road and the Manrahead Roundabout, and the general nature of medieval and post-medieval agricultural remains that could be buried in much of the site footprint (area 41).

7.5.2 In accordance with consultations with HES and WoSAS detailed in section 7.2.5, and using guidelines of CIfA regulations, standards and guidelines (Ref 7.9), it is recommended that a trial trench/pit be undertaken by an appropriate field archaeologist prior to construction commencing, within the areas of potential archaeological remains (Figure 7.1 and Figure 7.2) to identify and prevent damage to as yet unrecorded archaeological features or artefacts within the scheme footprint. This process would

serve to expose any features or deposits cut into the underlying subsoil. Should archaeological features be uncovered, they would then need to be excavated prior to construction work progressing. The main contractor and subcontractors will facilitate any such investigations. Any necessary mitigation measures arising from the watching brief will need to be agreed with WoSAS and potentially also HES where appropriate to determine the means of removal and the time and receptors required for further archaeological investigation.

7.5.3 Noise and dust pollution mitigation measures found in Chapter 6 Air Quality and Chapter 12 Noise and Vibration will be implemented to minimise the impacts upon the settings of cultural heritage receptors that also listed buildings, including Geilsland School (site 6) and the entrance to Spier's School (site 14).

7.5.4 No further mitigation is required for cultural heritage receptors after works have been completed.

7.6 Residual impacts

7.6.1 When the mitigation measures detailed in section 7.5 are in place, the scheme will have a temporary impact of moderate beneficial and slight beneficial magnitude on two receptors at Spier's School (sites 14 and 30), both resulting in an impact of slight beneficial significance. This is primarily because Barrmill Road/B706, which leads to these receptors from the northwest, will be converted into a footpath and cycle lane that will go past the listed entrance, thereby improving walking, riding and cycling access to the old Spier's Schools grounds. However, there will be an impact of minor adverse magnitude on the non-designated designed landscape at Spier's School (area 37) resulting in an impact of slight adverse significance due to an increase in noise and vibration and a slight decrease in air quality as a result of the new road infrastructure much closer to the western side of the receptor. The Chapter 12 Noise and Vibration (sections 12.11.8 to 12.11.12 and Table 12.33) assessment of the west façade of Geisland School building (site 6) concludes that following mitigation, the scheme has a short term significant adverse impact that reduces to no significant impact in the long term. Taking this into account and considering the disruption to tranquillity afforded at the setting due to the A737 being sited slightly closer to the school, the scheme is considered to have an impact of negligible adverse magnitude resulting in an impact of slight adverse significance on the Geilsland School building (site 6). There should be no impact on the remaining historic buildings and historic landscapes. As no further

mitigation is required for cultural heritage receptors after works have been completed, the residual permanent impacts are the same as assessed in sections 7.4.6 to 7.4.10.

7.6.2 Should the recommended mitigation be employed and archaeological remains are discovered on site, no significant impacts on archaeological remains are predicted. The impacts to cultural heritage receptors due to the scheme are summarised in Table 7.14.

Table 7.14: Summary of impacts

No.	Cultural heritage receptor	Sensitivity	Temporary impacts		Permanent impacts		Temporary residual impact after mitigation		Permanent residual impact after mitigation	
			MI[2]	SI[3]	MI	SI	MI	SI	MI	SI
6	Geilsland Road, Geilsland Church Of Scotland School, Category B Listed Building	Medium	Moderate adverse	Moderate adverse	Minor adverse	Slight adverse	Negligible	Slight adverse	Minor adverse	Slight adverse
14	Barrmill Road, gatepiers, railings and boundary walls to former Spier's School, Category C Listed Building	Low	Minor adverse	Slight adverse	Moderate beneficial	Slight beneficial	Moderate beneficial	Slight beneficial	Moderate beneficial	Slight beneficial
18	Crummock	Low	Moderate adverse	Slight adverse	Minor adverse	Slight adverse	Negligible	Neutral	Minor adverse	Slight adverse
30	Spier's School, grounds of	Low	Minor adverse	Slight adverse	Moderate beneficial	Slight beneficial	Moderate beneficial	Slight beneficial	Moderate beneficial	Slight beneficial

No.	Cultural heritage receptor	Sensitivity	Temporary impacts		Permanent impacts		Temporary residual impact after mitigation		Permanent residual impact after mitigation	
			MI[2]	SI[3]	MI	SI	MI	SI	MI	SI
36	Urban area, east of A737, within Geilsland School area	Low	Moderate adverse	Slight adverse	Minor adverse	Slight adverse	Negligible	Neutral	Minor adverse	Slight adverse
37	Designed landscape[1], between Geilsland Road and Barrmill Road	Low	Minor adverse	Slight adverse	Minor adverse	Slight adverse	Minor adverse	Slight adverse	Minor adverse	Slight adverse
38	Recreation area, between Geilsland Road and Wardrop Street	Low	Moderate adverse	Slight adverse	Minor adverse	Slight adverse	Negligible	Neutral	Minor adverse	Slight adverse

No.	Cultural heritage receptor	Sensitivity	Temporary impacts		Permanent impacts		Temporary residual impact after mitigation		Permanent residual impact after mitigation	
			MI[2]	SI[3]	MI	SI	MI	SI	MI	SI
40	Medieval/post-medieval settlement and agriculture, centred on NS 34591 53156	Unknown or Low	None	Neutral if no buried archaeological remains are present, otherwise Large adverse	Major adverse or No change	Moderate adverse or Neutral	None	Unknown significance or Neutral if no remains are found	Major adverse or No change	Moderate adverse or Neutral
41	Rectilinear fields and farms, found in most of the surrounding areas around Beith	Unknown or Low	None	Neutral if no buried archaeological remains are present, otherwise Large adverse	Major adverse or No change	Moderate adverse or Neutral	None	Unknown significance or Neutral if no remains are found	Major adverse or No change	Moderate adverse or Neutral

1 Not included in the Inventory of Gardens and Designed Landscapes compiled and maintained by HES
2 Magnitude of impact
3 Significance of impact

7.7 Statutory and planning context

7.7.1 Following the environmental impact assessment, the scheme can be assessed for compliance with statutory and planning policies. Table 7.15 sets out the legislation, plans and policies that are relevant to the scheme and indicates whether the scheme achieves the objectives of each.

Table 7.15: Statutory and planning context

Legislation / Plan / Policy	Description	Relevance to scheme and compliance	Achieves objectives? (Y/N)
Ancient Monuments and Archaeological Areas Act 1979	This Act (Ref 7.19) makes provision for the investigation, preservation and recording of matters of archaeological or historical interest and (in connection therewith) for the regulation of operations or activities affection such matters.	Desk study revealed the scheme is out with 300m of any scheduled monument, however compliance will be taken into account should any monuments become scheduled within 300m of the scheme during the course of works.	Y
Historic Environment Scotland Act 2014	This Act (Ref 7.20) establishes HES as a Non Departmental Public Body which will take over the functions of HS and the Royal Commission on Ancient and Historical Monuments of Scotland (RCAHMS). It sets out HES's role and legal status including changes in processes for the designation of monuments and buildings (scheduling and listing) and for	Previously in earlier stages of the EIA process for this scheme, consultations were made to the Royal Commission on the Ancient and Historic Monuments of Scotland (RCAHMS) and Historic Scotland (HS). This Act sets out why the scheme no longer consults with RCAHMS or HS and instead consults with HES.	Y

Legislation / Plan / Policy	Description	Relevance to scheme and compliance	Achieves objectives? (Y/N)
	consents relating to scheduled monuments, listed buildings and conservation areas.		
Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997	This Act (Ref 7.21) relates to controls and enforcements in respect of buildings and areas of special architectural or historic interest.	The assessment of potential impacts the scheme would have on listed buildings and areas of special architectural or historic interest is undertaken in this chapter and the process ensures the scheme is compliant with this Act. The assessment considers impact on the character of listed buildings or structures within the scheme and concludes that listed building consent is not required as no alterations will be made to the character of listed buildings or structures within the scheme.	Y
Historic Environment	This circular (Ref 7.22) describes Historic Environment Scotland (HES) functions in	RCAHMS and HS were previously consulted for this scheme. This circular sets out why the	Y

Legislation / Plan / Policy	Description	Relevance to scheme and compliance	Achieves objectives? (Y/N)
Circular 1 2015	relation to listing and scheduling, consents and appeals. Where Historic Scotland (HS) previously acted as a statutory consultee on behalf of Scottish Ministers, Historic Environment Scotland will carry out that function under its own authority from 1 October 2015.	scheme no longer consults with RCAHMS or HS and instead consults with HES.	
SHEP 2011	The SHEP (Ref 7.23) sets out Scottish Ministers' policies for the historic environment, provides greater policy direction for HES and provides a framework that informs the day-to-day work of a range of organisations that have a role and interest in managing the historic environment. This policy sets out the priorities of protecting the historic environment, securing greater economic benefits from it, and ensuring the people of Scotland and its visitors will value, understand and enjoy it.	The assessment ensures the scheme will comply with the principles set out by the policy, which includes the assertion that the historic environment is "precious" and "if it is lost or damaged, it cannot be replaced", by setting out mitigation measures.	Y

Legislation / Plan / Policy	Description	Relevance to scheme and compliance	Achieves objectives? (Y/N)
SPP 2014	The SPP (Ref 7.24) sets out the goals of the planning system including the protection of the designated and non-designated historic environment (including individual receptors, related settings and the wider cultural landscape). It enables positive change to the historic environment informed by a clear understanding of the importance of the cultural heritage affected to ensure their future use.	The assessment undertaken in this chapter of the scheme's impacts on the designated and non-designated historic environment and the mitigation measures set out as a result of that assessment ensures the scheme is compliant with the SPP.	Y
The Scottish Government NPF3 2014	This is the Scottish Government's strategy for Scotland's long term spatial development that is read in conjunction with Scottish Planning Policies (SPP) (Ref 7.25). The NPF3 document states that the Scottish Government "will respect, enhance and make responsible use of our natural and cultural assets" and that the "historic environment is an integral part of our well-being and cultural identity".	The assessment is undertaken in recognition of the NPF3 statement that the "increased vulnerability of the historic building stock will also need to be factored into planning decisions over the longer term". The assessment considers the temporary, permanent and residual impacts on cultural heritage receptors and puts forward mitigation measures to ensure the scheme is compliant with the NPF3 statement.	Y

Legislation / Plan / Policy	Description	Relevance to scheme and compliance	Achieves objectives? (Y/N)
PAN 2/2011: Planning and Archaeology	This provides advice and information on technical planning to inform the day-to-day work of a range of local authority advisory services and other organisations that have a role in the handling of archaeological matters within the planning process (Ref 7.26).	The assessment is informed by the advice set out in the PAN however as a trunk road this scheme does not require planning permission.	N/A
North Ayrshire LDP 2014	This LDP (Ref 7.27) is a land-use planning document that indicates where certain types of development should and should not happen in North Ayrshire.	The assessment complies with section 8 of the LDP, which is dedicated to the historic environment within the area of the scheme. The LDP sets out policies for: • Policy HE 1 'Conservation Areas'; • Policy HE 2 'Listed Buildings'; and • Policy HE 4 'Scheduled Ancient Monuments and Archaeological Sites'. Although as a trunk road this scheme does not require planning permission, the policies are taken into account in the assessment.	Y

7.8 Limitations

7.8.1 The impact of this scheme on archaeological cultural heritage depends on whether buried archaeological remains exist within the scheme footprint. However, mitigation measures are set out in section 7.5 that will ensure potential archaeological remains are protected and prevent risks to the scheme.

7.9 Conclusion

This assessment identified and conducted a simple assessment on nine cultural heritage receptors that may be impacted by the scheme. It is concluded that with mitigation in place, the scheme will have a significant slight beneficial impact on two receptors at Spier's School (sites 14 and 30). Conversely, the scheme is likely to cause a significant slight adverse impact on the Geilsland School building (site 6) and the non-designated designed landscape at Spier's School (site 37) due to disruption to tranquillity afforded at both settings because the A737 will be slightly closer. Following mitigation there should be no significant impact on the remaining historic buildings and historic landscapes.

8 Landscape Effects

8.1 Introduction

8.1.1 This chapter provides the likely impacts on landscape and visual receptors arising from the construction and operation of the scheme. The objective of the chapter is to assess the potential impacts that the scheme may pose on the character of the landscape and on the quality of the views, and to provide appropriate and effective mitigation.

8.1.2 The impact of the project is assessed in accordance with the principles described within Interim Advice Note (IAN) 135/10 Landscape and Visual Effects (Ref 8.1). IAN 135/10 supersedes the guidance offered within the Design Manual for Roads and Bridges (DMRB); Volume 11; Environmental Assessment Techniques; Section 3 Part 5; Landscape Effects (1994) (Ref 8.2). The Guidelines for Landscape and Visual Impact Assessment (Third Edition) were also consulted. In line with IAN 135/10, landscape and visual assessments are undertaken as separate procedures. Landscape impacts are the changes to the physical landscape which impact landscape character, while visual impacts are the modifications to existing views and how the landscape is experienced by visual receptors.

8.1.3 The scheme has the potential to impact landscape character as a result of:

- The creation of the proposed A737 and the addition of Barrmill Roundabout and Head Street Roundabout
- The change in use of agricultural land to trunk road network
- Alterations to the natural topography of the landscape
- The removal of woodland, grassland, hedgerow and other vegetation along the proposed road alignments
- The loss of boundary treatments.

8.1.4 It is important to note that some other topics within the ES may touch on landscape issues and care must be taken to avoid "double counting". The loss of agricultural land in relation to the value of the land from an agricultural perspective is assessed within Chapter 14 Community and Private Assets.

8.1.5 Potential issues arising from the scheme that are relevant to visual include:

- The loss of views from visual receptors

- Adverse visual impacts as a result of new road infrastructure (eg street lighting, road signage, fences and barriers).

8.2 Methodology

8.2.1 In compliance with IAN 135/10, the impacts on both landscape character and visual amenity are assessed at a detailed level. IAN 135/10 recommends that a detailed assessment should be used when significant landscape impacts in terms of duration and scale (such as offline improvements) are likely to arise from the scheme and for visual impacts where there are sensitive receptors in the immediate vicinity of the project.

Statutory and planning review

8.2.2 A desktop review of current legislation, planning policy and technical guidance was carried out in December 2015 to identify all relevant information on the project in relation to landscape.

8.2.3 The following information sources were used:

- Scottish National Planning Framework 3 (Ref 8.3)
- North Ayrshire Local Development Plan (LDP) (Ref 8.4)
- Scottish Planning Policy (SPP) (Ref 8.5)
- Scottish Rural Development Programme (SRDP) (Ref 8.6)
- Planning Advice Note (PAN) 60 Planning for Natural Heritage (Ref 8.7)
- PAN 65 Planning for Open Space (Ref 8.8)
- The Planning etc. (Scotland) Act (2006) (Ref 8.9)
- Transport Scotland: Fitting Landscapes (Ref 8.10)

Determination of baseline

8.2.4 Baseline conditions relevant to landscape and visual amenity were determined by desk based study, field study and consultation with relevant parties.

Study area

8.2.5 In accordance with IAN 135/10, a study area must be established at the outset of the assessment. This covers the area to be assessed and will contain all of the likely impacts of the project on any component of the landscape and visual resource.

8.2.6 For landscape impacts, the study area should cover the proposed project site and the wider landscape context within which the project may influence landscape character. For this assessment, the study area is determined to be a 1km radius from the centre line of the proposed scheme. Impacts beyond this distance are unlikely as the distance is too far for the scheme to influence landscape character.

8.2.7 For visual impacts, the study area should extend to the whole of the area from which the project could be visible, considering factors such as screening from vegetation and topography. For this assessment, the study area for visual impacts is largely determined to be a 500m radius from the centre line of the scheme. This radius is adopted as views from the scheme centre line are generally restricted outwards to this point due to screening from topography, vegetation and building frontages. The study area extends to 1km only in some areas, particularly to the south and south west of Manrahead Roundabout, where there are long distant views due to a lack of screening from vegetation and the topography of the land. Beyond 1km, the impacts will not be perceptible in the view and are therefore insignificant.

Desk study

8.2.8 A desk study was undertaken to obtain baseline conditions for both landscape and visual. The following information sources were utilised:

- North Ayrshire LDP (Ref 8.4)
- Department of Food, Environment and Rural Affairs (DEFRA) Multi Agency Geographic Information for the Countryside (MAGIC) Map (Ref 8.11)
- Scottish Natural Heritage (SNH) Interactive Map (Ref 8.12)
- Scottish Natural Heritage Ayrshire Landscape Character Assessment (Ref 8.13)
- Historic Environment Scotland (HES) Pastmap, previously compiled by Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) (Ref 8.14)
- Google Maps (Ref 8.15)
- Scotland's Environment Interactive Map (Ref 8.16)

8.2.9 Information was also obtained from the A737 Improvements at Beith Stage 2 EIA.

Landscape character assessment

8.2.10 As part of the desk study to obtain baseline information relevant to landscape, Scottish Natural Heritage's Landscape Character Assessment (LCA) for the Ayrshire region was consulted. LCAs divide Scotland into distinct areas and provide a factual description of the components that make up the landscape (landcover, geology and land use) together with a description of experiential elements (tranquillity and human interaction). The information provided within this LCA was utilised to provide baseline data for the regional and local landscape.

Zone of visual influence

8.2.11 Baseline conditions for the visual assessment were determined by gaining an understanding of the visual amenity of the area (eg the value of the area or view in terms of what is seen) and the potential extent of visibility of the project. This was achieved by desk study using online maps and resources, and later supported by a field study. Using professional judgement, a Zone of Visual Influence (ZVI) was mapped. A ZVI illustrates the area of land from which there could be a view of any part of the scheme and also includes visual receptors which may or may not have a view of the project; typical visual receptors include residential and commercial properties as well as recreational spaces. Landscape elements such as tree lines, buildings and the natural topography of the land often restrict views and the extent of the ZVI. The ZVI was prepared using the scenario of winter in the year of opening. Once identified, the ZVI is used to support the impact assessment.

Field study

8.2.12 Site visits to the study area were undertaken on 10 November and 2 December 2015, to verify and update the information obtained from the desk study. The site visits were also an opportunity to further examine the landscape and visual impacts associated with the scheme, and to consider appropriate mitigation measures. Photographs were taken during both site visits to support the assessment process.

Consultation

8.2.13 Consultations were undertaken with a range of statutory and non-statutory organisations including:

- Historic Environment Scotland (HES)
- Scottish Natural Heritage (SNH)

- Scottish Environment Protection Agency (SEPA)
- North Ayrshire Council
- Beith Cultural and Heritage Society

8.2.14 No responses were received raising any issues in regards to landscape and visual assessment. Further information on the consultations undertaken is available in Chapter 5.

Limitations

8.2.15 The assessment of temporary impacts is limited due to a lack of construction information. At the time of writing, construction site plans are unavailable and it is unknown where construction compounds, haul roads and traffic management will be located.

Assessment of impact

8.2.16 Impacts have been considered for both the construction and operation phases of the scheme. Construction phase impacts are those temporary impacts which arise during the construction of the scheme; for more information on the scheme construction refer to Chapter 3 Construction, Operation and Maintenance. Operation impacts are those associated with a long term or permanent change in the existing fabric or character after completion of the proposed works. It should be noted that the assessment considers impacts prior to mitigation and also with mitigation in place. The assessment during construction and immediately post construction are assessed without mitigation, while residual impacts in year one and year 15 are assessed with mitigation.

8.2.17 The operation phase assessment is undertaken at different points in time to represent worst and least case scenarios. This includes:

- In the winter of the year of opening (maximum impact scenario)
- In the summer of the fifteenth year after opening (least impact scenario)

8.2.18 To assess the potential impacts of the scheme, the sensitivity of both landscape and visual receptors and the degree of change that any impact will have on the landscape and views must be determined.

Landscape impact significance

8.2.19 In line with the IAN 135/10, the sensitivity of landscape is considered in accordance with Table 8.1. Landscape sensitivity is linked to the character of the receiving landscape, the

nature of the scheme and the type of change. Highly sensitive landscapes contain features which typically would not be able accommodate change (eg designated sites at an international level) while moderate and low sensitive landscapes typically contain features which are more flexible to change (eg poor quality land and vegetation). Table 8.1 provides descriptions of landscapes with high, moderate and low sensitivity.

Table 8.1: Determination of landscape sensitivity

Sensitivity	Description
High	Landscapes which by nature of their character would be unable to accommodate change of the type proposed. Typically these would be: • Of high quality with distinctive elements and features making a positive contribution to character and sense of place • Likely to be designated, but the aspects which underpin such value may also be present outside designated areas, especially at the local scale • Areas of special recognised value through use, perception or historic and cultural associations • Likely to contain features and elements that are rare and could not be replaced
Moderate	Landscapes which by nature of their character would be able to partly accommodate change of the type proposed. Typically these would be: • Comprised of commonplace elements and features creating generally unremarkable character but with some sense of place • Locally designated, or their value may be expressed through non-statutory local publications • Containing some features of value through use or perception or historic and cultural associations • Likely to contain some features and elements that could not be replaced
Low	Landscapes which by nature of their character would able to accommodate change of the type proposed. Typically these would be: • Comprised of some features and elements that are discordant, derelict or in decline, resulting in indistinct character with little or no sense of place • Not designated

Sensitivity	Description
	• Containing few, if any, features of value through use, perception or historic and cultural associations • Likely to contain few, if any, features and elements that could not be replaced

8.2.20 The magnitude of impact of a scheme on landscape is considered to be adverse, neutral or beneficial. This is determined using professional judgement based upon an evaluation of the scheme and of the receiving landscape. Table 8.2 provides guidance for this determination and outlines typical descriptions for impacts of major adverse magnitude through impacts to major beneficial magnitude. This guidance was used to ascertain the magnitude of impact on landscape for the scheme.

Table 8.2: Landscape magnitude of impact

Magnitude of impact	Description
Major adverse	Total loss or large scale damage to existing character or distinctive features or elements, and/or the addition of new but uncharacteristic conspicuous features and elements
Moderate adverse	Partial loss of noticeable damage to existing character or distinctive features and elements, and or the addition of new but uncharacteristic noticeable features and elements
Minor adverse	Slight loss or damage to existing character or features and elements and/or the addition of new but uncharacteristic features and elements
Negligible adverse	Barely noticeable loss or damage to existing character or features, and/or the addition of new but uncharacteristic features and elements
No change	No noticeable loss, damage or alteration to character or features or elements
Negligible beneficial	Barely noticeable improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements
Minor beneficial	Slight improvement of character by the restoration of existing features and elements, or by the addition of new characteristic elements

Magnitude of impact	Description
Moderate beneficial	Partial or noticeable improvement of character by the restoration of existing features and element, and/or the removal of uncharacteristic and noticeable features and elements, or by the addition of new characteristic features
Major beneficial	Large scale improvement of character by the restoration of features and elements, and/or the removal of uncharacteristic and conspicuous features and elements, or by the addition of new distinctive features

Visual impact significance

8.2.21 The sensitivity of visual receptors is assessed in accordance with Table 8.3. Each visual receptor within the ZVI is categorised as having high, moderate or low sensitivity to change. Sensitivity is determined by factors such as location, context and expectations of the viewer. Highly sensitive visual receptors include residential properties and recreational facilities which hold open views of the countryside. Low or moderate sensitive receptors include places of work and properties whose purpose is not related to the view. Descriptions for high, moderate and low sensitivity are provided in Table 8.3. This guidance was used to determine the sensitivity of each visual receptor within the ZVI.

Table 8.3: Visual sensitivity

Sensitivity	Description
High	• Residential properties • Users of Public Rights of Way or other recreational trails (eg national trails, footpaths, bridleways etc.) • Users of recreational facilities where the purpose of that recreation is enjoyment of the countryside (eg country parks, National Trust or other access land etc.)
Moderate	• Outdoor workers • Users of scenic roads, railways or waterways or users of designated tourist routes • Schools and other institutional buildings, and their outdoor areas

Sensitivity	Description
Low	• Indoor workers • Users of main roads (eg trunk roads) or passengers in public transport on main arterial routes • Users of recreational facilities where the purpose of that recreation is not related to the view (eg sports facilities)

8.2.22 The determination of impact magnitude for visual is assessed in accordance with Table 8.4. The magnitude of impact of a scheme on visual receptors is considered to be major, moderate, minor, negligible or no change. An adverse or beneficial impact is also required to be established. This is determined for each visual receptor using professional judgement based upon a review of the scheme considering factors such as; the scale of change, the nature of change and the duration of change. Table 8.4 provides guidance for this determination and outlines descriptions for major impact through to no change. This guidance was used to ascertain the magnitude of impact of the scheme on each visual receptor.

Table 8.4: Visual magnitude of impact

Magnitude of impact	Description
Major	The project, or part of it, would become the dominant feature or focal point of the view
Moderate	The project, or part of it, would form a noticeable feature or element of the view which is readily apparent to the receptor
Minor	The project, or part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view
Negligible	Only a very small part of the project would be discernible, or it is at such a distance that it would form a barely noticeable feature or element of the view
No change	No part of the project, or work or activity associated with it, is discernible

8.2.23 The evaluation of the significance of impacts is derived by assessing the sensitivity of the landscape and visual receptors in combination with the magnitude of impact. This process is illustrated in Table 8.5.

8.2.24 For landscape impacts, the assessment of their significance is determined by considering the magnitude of impact arising from the scheme on each of the features that make up landscape bearing in mind the value of the landscape, and the ability of the landscape to accommodate change. Table 8.6 outlines descriptions for landscape significance of impact categories.

8.2.25 For visual impacts, the assessment of their significance is determined by considering the sensitivity of the receptor to the magnitude of the change in visual amenity arising from the scheme. Table 8.7 outlines descriptions for visual significance of impact categories.

8.2.26 For both landscape and visual, an impact significance of moderate or above is determined to be a significant impact.

Table 8.5: Significance of impact categories

		Magnitude of impact				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Sensitivity	High	Neutral	Slight	Slight/ moderate	Moderate/ large	Large/ very large
	Moderate	Neutral	Neutral/ slight	Slight	Moderate	Moderate /large
	Low	Neutral	Neutral/ slight	Neutral/ slight	Slight	Slight/ moderate

Table 8.6: Description of landscape significance of impact categories

Significance	**Description**
Very large beneficial	The project would: • Greatly enhance the character (including quality and value) of the landscape • Create an iconic high quality feature and/or series of elements • Enable a sense of place to be created or greatly enhanced
Large beneficial	The project would: • Enhance the character (including the quality and value) of the landscape • Enable the restoration of characteristic features and elements lost as a result of changes from inappropriate management or development • Enable a sense of place to be enhanced

Significance	Description
Moderate beneficial	The project would: • Improve the character (including quality and value) of the landscape • Enable the restoration of characteristic features and elements partially lost or diminished as a result of changes from inappropriate management or development • Enable a sense of place to be restored
Slight beneficial	The project would: • Complement the character (including quality and value) of the landscape • Maintain or enhance characteristic features and elements • Enable some sense of place to be restored
Neutral	The project would: • Maintain the character (including quality and value) of the landscape • Blend in with characteristic features and elements • Enable a sense of place to be retained
Slight adverse	The project would: • Not quite fit the character (including quality and value) of the landscape • Be at variance with characteristic features and elements • Detract from a sense of place
Moderate adverse	The project would: • Conflict with the character (including quality and value) of the landscape • Have an adverse impact on characteristic features or elements • Diminish a sense of place
Large adverse	The project would: • Be at considerable variance with the character (including quality and value) of the landscape • Degrade or diminish the integrity of a range of characteristic features and elements • Damage a sense of place

Significance	Description
Very large adverse	The project would: • Be at complete variance with the character (including quality and value) of the landscape • Cause the integrity of characteristic features and elements to be lost • Cause a sense of place to be lost

Table 8.7: Description of visual significance of impact categories

Significance	Description
Very large beneficial	The project would create an iconic new feature that would greatly enhance the view
Large beneficial	The project would lead to a major improvement in a view from a highly sensitive receptor
Moderate beneficial	The proposals would cause obvious improvement to a view from a moderately sensitive receptor, or perceptible improvement to a view from a more sensitive receptor
Slight beneficial	The project would cause limited improvement to a view from a receptor of medium sensitivity, or would cause greater improvement to a view from a receptor of low sensitivity
Neutral	No perceptible change in the view
Slight adverse	The project would cause limited deterioration to a view from a receptor of medium sensitivity, or cause greater deterioration to a view from a receptor of low sensitivity
Moderate adverse	The project would cause obvious deterioration to a view from a moderately sensitive receptor, or perceptible damage to a view from a more sensitive receptor
Large adverse	The project would cause major deterioration to a view from a highly sensitive receptor, and would constitute a major discordant element in the view
Very large adverse	The project would cause the loss of views from a highly sensitive receptor, and would constitute a dominant discordant feature in the view

8.3 Baseline conditions

Landscape baseline

8.3.1 As discussed in paragraph 8.2.10, the study area is covered by the SNH LCA of Ayrshire. Within the LCA for Ayrshire, the region is subcategorised into Regional Character Areas (RCAs) and Landscape Types. The proposed project lies within the Ayrshire Basin RCA and is categorised as Broad Valley Lowland.

8.3.2 The Ayrshire Basin comprises the extensive semi-circle of lowland surrounding the settlement of Ayr. The area is bounded to the north by the Renfrew Heights and to the east and south by the Ayrshire Rim and Carrick Hills and Valleys. The basin varies in elevation, draining from east to west. In comparison to the other areas of the Ayrshire region, the Ayrshire Basin is heavily populated with a dense network of settlements and roads. A primary land use within this area is dairy farming which has resulted in the survival of many of the area's hedgerows.

8.3.3 The RCA has been further divided by SNH into Landscape Types. These are defined by SNH as tracts of countryside which have a unity of character due to particular combinations of landform, land cover and a consistent and distinct pattern of constituent elements. The scheme lies within the Garnock Valley of the Ayrshire Basin RCA which has been classified by SNH as a Broad Valley Lowland Landscape Type.

8.3.4 The valley is underlain by millstone grit and crossed by igneous dykes. It has been substantially modified by glacial erosion forming a comparatively broad, shallow breach valley between the Ayrshire lowlands and the Clyde basin. SNH describe the valley as having a broad and level floor which is naturally flooded to form Kilbirnie Loch and Barr Loch. Other areas have been drained to allow the creation of level fields. The lower valley slopes are currently used for agricultural grassland, with upper slopes containing moorland.

8.3.5 The valley contains a dense network of woodland, consisting of shelterbelts, hedgerow trees, trees along burns and gullies and those associated with large estates. Agriculture dominates the lower valley slops, predominantly pasture or lay grassland with some arable, while the higher slopes contain moorland. Field sizes in the lower valley slopes are relatively small.

8.3.6 The landscape character can be detailed further through a description of the individual elements that influence the area. Following recommendations outlined within

IAN 135/10, landscape elements including landcover, pattern and texture, scale and appearance, tranquillity, cultural and human interaction are considered.

8.3.7 It should be noted that there are no records of any National or Regional Scenic Areas, Gardens and Designed Landscapes or Scheduled Monuments within 1km of the scheme.

Landcover, pattern and texture

8.3.8 The study area is dominated by urban and agricultural land. The town of Beith lies to the west of the A737 and contains residential and commercial properties. The area of the settlement which bounds the A737 is predominantly residential properties, road space and small areas of recreational space. Open agricultural land lies to the east and southeast of the A737 and is interspersed with small clusters of woodland and small rural dwellings. Between Threepwood Road and Geilsland Road in the northern extent of the study area, the agricultural land is of poor quality and contains areas of rough grassland and poor quality shrub. To the immediate north of Geilsland Road, the agricultural land is marshy and prone to flooding from surface water; this area is illustrated in Photograph 8.1. Towards the southern extent of the study area, the farmland to the east of the A737 improves in quality and there are open views of the surrounding hills, as shown in Photograph 8.2. The road is elevated above the adjacent fields and the field boundaries primarily consist of hawthorn hedgerow *Crateagus monogyna* and scrub.

Photograph 8:1: View of farmland to the east of the A737

Photograph 8:2: View of landscape from Spiersland Way looking southwest

Scale and appearance

8.3.9 The fields within the study area are primarily small to medium in size and do not follow any linear pattern. Lines of trees are present in most fields yet the majority do not contain any significant clusters of woodland. The largest area of woodland within the scheme vicinity lies to the east of the A737 between Barrmill Road and Geilsland Road. This area is Spier's Old School Grounds which contains dense mixed woodland.

8.3.10 The A737 is the dominant feature of the landscape and this greatly influences the character of the area. Residential properties lie immediately to the west of the carriageway, while agricultural land and farm buildings lie to the east. The residential properties vary in size yet are primarily detached, semi-detached and terrace dwellings. Head Street, Larch Terrace, Rowan Street and McMillan Crescent predominantly contain two storey, semi-detached dwellings, while larger detached properties are situated on Glebelands Way and Grahamfield Place. Larger stone built properties are also present along Barrmill Road and at the A737/Barrmill Road junction. The vast majority of properties are situated within close proximity to the A737, yet not immediately on the roadside. Only a small number of properties lie immediately along the roadside and these are clustered around the A737/Barrmill Road junction. The boundary treatments which separate the A737 and the surrounding land are a mix of wooden fences, stone walls, hedgerows and safety barriers.

8.3.11 Photograph 8.3 illustrates the appearance of the landscape from Geilsland School.

Photograph 8:3: View of landscape from Geilsland School looking southwest

Tranquillity

8.3.12 Tranquillity is an element which contributes to overall landscape character. Factors to consider when determining an area's tranquillity include; the remoteness and sense of isolation of the region and the presence or absence of built development and traffic.

8.3.13 The A737 is a dominant feature of the study area. The road runs immediately adjacent to the town of Beith and experiences a high flow of traffic throughout the daytime; further information on traffic is available in Chapter 13 Effects on All Travellers. The area surrounding this road subsequently experiences consistent traffic noise which disturbs its tranquillity. As distance from the A737 increases in an eastward direction however, traffic noise decreases and a greater level of tranquillity is evident. Photograph 8.4 illustrates the view of the existing A737 looking southwest.

Photograph 8:4: View of the A737 looking southwest

8.3.14 Tranquillity within the study area is further disrupted due to the proximity of Glasgow International Airport. This lies approximately 10km to the north of Beith. As a result, the study area experiences noise disturbance from low flying aeroplanes as they approach and depart the airport.

8.3.15 Street lighting is additionally present at numerous locations along the A737 within the study area which disrupts the tranquillity of the area. Lighting is present at Manrahead Roundabout and along the junctions at Barrmill Road, Glebe Road and Head Street.

Cultural heritage

8.3.16 Beith Conservation Area lies approximately 300m from the centreline of the scheme footprint. This area is designated due to its large number of listed buildings; all of which are either Category B or Category C listed. Geilsland School, located outwith Beith Conservation Area on Geilsland Road, is a Category B listed building and the Gatepiers, railings and boundary walls of Spier's Old School Grounds are Category C listed. A number of stone walls are present within the study area and contribute to the region's historic environment. Stone walls run along either side of Wardrop Street and act as boundary treatments separating the road and the surrounding agricultural land, as

shown in Photograph 8.5. As previously noted, the area predominantly contains small to medium sized fields and the field boundaries consist of hawthorn hedgerow and scrub. In the southern extent of the study area there are remnants of field boundaries within the larger fields. Chapter 7 Cultural Heritage provides further information on the area's cultural heritage.

Photograph 8:5: Stone wall and agricultural land to the north of Wardrop Street

Human interaction

8.3.17 Land use within the study area is predominately residential and agricultural. The town of Beith contains a large number of residential properties and the A737 is used by motorists to access this settlement. One commercial property lies within the study area; Thomson of Beith. This is a small car garage containing a BP petrol station and a car wash. The property lies immediately west of the A737 to the north of Head Street.

8.3.18 No cycle routes or core paths lie within the study area. Geilsland Road and Wardrop Street are however used by both pedestrians and equestrians. A small footway runs along the western edge of the A737 for the entire scheme extents.

8.3.19 Chapter 13 Effects on All Travellers and Chapter 14 Community and Private Assets provide more information on human interaction.

Summary

8.3.20 Following characterisation of the landscape baseline, the sensitivity of the landscape is assessed using Table 8.1. It is considered that the regional landscape has a low sensitivity due to a lack of designated sites. The local landscape is determined to have a moderate sensitivity due the presence of landscape features which are valued by the local community eg Spier's Old School Grounds. The sensitivity for each local landscape element is outlined in Table 8.8.

Table 8.8: Landscape sensitivity

Landscape feature	**Sensitivity**
Regional landscape	Low
Local landscape	Moderate
Landcover, pattern and texture	Moderate
Scale and appearance	Low
Tranquillity	Low
Cultural	Low
Human interaction	Low

Visual baseline

8.3.21 The ZVI, as shown in Figure 8.1, illustrates the area within which the scheme may impact visual amenity. It shows the full extent of the visibility of the project and illustrates the line of the proposed scheme, the principal representative viewpoints (eg the type and range of views) and major visual barriers (eg ridgelines, skylines, tree lines, vegetation and boundary treatments). The limit of the ZVI is also shown. Figure 8.1 reveals that views to the west of the scheme are generally restricted, primarily due to residential properties within Beith and their associated boundary treatments. Trees and vegetation also restrict views in this direction. Views to the east and south east of the scheme are greater due to the surrounding agricultural land and general lack of development. At the southern end of the scheme, there are extensive views to the Island of Arran and surrounding hills.

8.3.22 Figure 8.1 also reveals that there are 32 visual receptors present within the ZVI; the majority of which are residential properties. The receptors experience varying degrees of

visibility of the existing A737 and of the scheme. The Visual Effects Drawing, as shown in Figure 8.2, shows the receptors which have a view of the scheme while Drawing 25000199/100/167 illustrates a photographic record of views from the proposed scheme towards the visual receptors. Residential properties which have similar views as one another are grouped and classified as one receptor. Within farmsteads, the farmhouse is taken as the main receptor and not any associated outbuildings or farmland.

8.3.23 The following paragraphs describe each visual receptor along with their sensitivity to change which was determined using Table 8.3. It should be noted that the sensitivity of all residential properties is determined to be high as residents will be highly sensitive to changes in their views. All photographs were taken during the winter months.

Visual receptor 1

Crummock Farmhouse

8.3.24 This property lies to the immediate east of the A737, opposite the residential area of Crummock Gardens. It is a single storey, agricultural property constructed from stone. Dense vegetation and tall trees surround the majority of the property, restricting its views of the A737 to the west. Photograph 8.6 illustrates the view of the property from the existing A737, close to the proposed tie-in of the proposed alignment. Gaps in the vegetation to the south of the property will provide some screened views of the A737 and of the scheme. Views will be increased during the winter months due to the presence of deciduous trees; in this case larch *Larix decidua*. The sensitivity of this receptor is determined to be high.

Photograph 8:6: View of Crummock farm looking east

Visual receptor 2

Farmhouse, Hill at Beith

8.3.25 This property lies to the northeast of the A737 and is a two storey farmhouse constructed of stone with a pitched slate roof. It lies at the end of a secluded lane and it is surrounded by several outbuildings which are in a state of decline. Within the property boundary there is mature beech *Fagus sylvatica* and hawthorn hedgerow approximately 1.5m high. The hedgerow has mature sycamore *Acer pseudoplatanus* and beech trees set within it. Views of the A737 can be experienced from the upper floors looking west as outbuildings and vegetation help screen the road for lower floors. Views to the north and east are of open countryside. Photograph 8.7 illustrates the view of the farmhouse from the new A737 alignment. The sensitivity of this receptor is determined to be high.

Photograph 8:7: View of farmhouse at Hill of Beith looking east

Visual receptor 3

Netherhill, Wardrop Street

8.3.26 This is a two storey stone constructed dwelling with a pitched slate roof. The property lies immediately on the roadside to the south of Wardrop Street and consists of two separate apartments. The properties do not have views of the existing A737 due to their distance from the road yet have oblique views of Wardrop Street. The upper apartment has a clear view of Wardrop Street looking west. Views to the north, east and south are of agricultural land. The sensitivity of this receptor is determined to be high.

Visual receptor 4

The Gatehouse, Wardrop Street

8.3.27 This is a small cottage located on Wardrop Street to the east of the A737. The property is constructed from stone with a pitched slate roof. A small stone wall designates its boundary with Wardrop Street and a mature hawthorn hedge, approximately 1.5m high, designates its boundary to open agricultural land immediately to the west. The property

has direct views of Wardrop Street to the north and limited, distant views of the A737 to the west. The sensitivity of this receptor is determined to be high.

Visual receptor 5

Properties 18-20, Wardrop Street

8.3.28 Properties 18-20 lie at the western extent of Wardrop Street and consist of a mix of detached and semi-detached dwellings. All three of the properties are situated immediately on the roadside on the southern edge of Wardrop Street. No boundary treatments separate the properties from the footway. The properties experience oblique views of the A737 looking northwest and southwest, and direct, elevated views of Wardrop Street and farmland immediately to the north. Photograph 8.8 illustrates the view of the receptor from the proposed alignment of Wardrop Street. The sensitivity of this receptor is determined to be high.

Photograph 8:8: View of 18-20 Wardrop Street looking south

Visual receptor 6

Geilsland School

8.3.29 Geilsland School lies to the east of the A737, located between Wardrop Street and Geilsland Road. It consists of a two storey main building and numerous single storey outbuildings, many of which have fallen into a dilapidated state. The school grounds are extensive and contain mature trees and a mix of native hedgerow. The school has varying views of the existing A737. To the northwest the school experiences distant open views of the road, while to the southwest the view is obstructed slightly due the natural topography of the land. Photograph 8.9 illustrates the view of the school from the proposed A737. The sensitivity of this receptor is determined to be moderate as viewers from the receptor will not occupy the property full time.

Photograph 8:9: View of Geilsland School looking east

Visual receptor 7

Properties 12 and 14 Barrmill Road

8.3.30 Properties 12 and 14 lie to the east of the A737 close to Barrmill Road junction. They are stone constructed, semi-detached dwellings over two floors. A stone and railing wall

delineates the boundary of the properties with a small access road to the front. An area of farmland lies immediately to the rear. Both properties have direct unobstructed views of the existing A737 to the west and experience open, elevated views of farmland and woodland to the east, northeast and southeast. Photograph 8.10 illustrates the view of the properties from the centre line of the proposed A737. The sensitivity of this receptor is determined to be high.

Photograph 8:10: View of 12 and 14 Barrmill Road looking southwest

Visual receptor 8

16 Barrmill Road

8.3.31 Property 16 is a stone built cottage situated on Barrmill Road to the southeast of the A737. The property is a one storey dwelling with outbuildings to the rear. A stone and iron railing wall, together with a hawthorn hedge, delineates the boundary of the property with Barrmill Road. The property experiences clear views of the existing A737 to the northwest and open views of agricultural land and woodland to the east and northeast. Photograph 8.11 illustrates the view of the receptor from the proposed A737 alignment. The sensitivity of this receptor is determined to be high.

Photograph 8:11: View of 16 Barrmill Road looking southwest

Visual receptor 9

45 Barrmill Road

8.3.32 Property 45 is a detached, two storey residential property constructed from stone located on Barrmill Road to the south of the existing A737. A stone and railing wall delineates the boundary of the property with Barrmill Road to the northeast and agricultural land to the west. Spiersland Way runs immediately to the east of the property. The property experiences distant views of the existing A737 from its upper north and west facing windows and clear, direct views of agricultural land to the northeast, west, northwest and southwest. Photograph 8.12 illustrates the view of the receptor from the centre line of the proposed A737 alignment. The sensitivity of this receptor is determined to be high.

Photograph 8:12: View of 45 Barrmill Road looking southeast

Visual receptor 10

2 Spiersland Way

8.3.33 Two Spiersland Way is a single storey cottage situated to the immediate southwest of 45 Barrmill Road. Similar to property 45, the receptor experiences distant views of the A737 to the northwest, screened slightly by the presence of deciduous trees and vegetation in the property's rear garden, and direct views of agricultural land to the west, northwest and southwest. The property additionally experiences long distant views of Goat Fell on the Island of Arran to the northwest. Photograph 8.13 illustrates the view of the property from the proposed A737 alignment. The sensitivity of this receptor is determined to be high.

Photograph 8:13: View of 2 Spiersland Way looking southeast

Visual receptor 11

Manrahead Farmhouse

8.3.34 This agricultural property lies to the southeast of Manrahead Roundabout. It consists of a large stone built farmhouse and associated outbuildings. The farmhouse is a two and a half storey structure which has distant views of the A737 from its north and northwest facing windows. A line of mature trees run to the front of the property yet are intermittently placed and do not offer any significant screening of the existing A737. Views to the east and south are of open farmland. Photograph 8.14 illustrates the farmhouse as seen from the proposed alignment of Manrahead Roundabout. The sensitivity of this receptor is determined to be high.

Photograph 8:14: View of Manrahead farm looking southeast

Visual receptor 12

Group of properties Jamieson Way, Dalry Road, Manuel Avenue, McMillan Crescent, Spiers Avenue and St Andrews Place

8.3.35 This receptor includes 54 properties on Jamieson Way, Dalry Road, Manuel Avenue, St Andrews Place, Spiers Avenue and McMillan Crescent are residential areas which lie to close to the existing Manrahead Roundabout. The properties at this location are a mix of terraced and semi-detached dwellings. Many of the properties have similar views.

8.3.36 Properties 1-7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31 Jamieson Way are predominantly terraced properties. Properties 1-7, 9, 11, 13, 15 currently experience oblique views of Manrahead Roundabout looking southeast. Properties 17, 19, 21, 23, 25, 27, 29 experience oblique views of Manrahead Roundabout from their upper rear windows looking southeast and direct elevated views of the B777 and farmland to the southwest.

8.3.37 Dalry Road is situated to the immediate east of Jamieson Way and contains similar terraced housing. Properties 21, 23, 33 and 35 have oblique views of Manrahead Roundabout looking southwest and oblique views of the existing A737 looking southeast.

Views of the A737 are restricted slightly by the presence of vegetation to the rear of the properties.

8.3.38 Manuel Avenue is located off Dalry Road and runs to the north of Jamieson Way. This residential area predominantly contains semi-detached dwellings. Properties 1 and 2 have distant oblique views of Manrahead Roundabout from their upper floors looking south.

8.3.39 St Andrews Place and Spiers Avenue lie to the northwest of Manrahead roundabout and contain semi-detached two storey properties constructed from brick. The rear of the properties face southwest out towards the B777 and open farmland. A line of dense trees and vegetation run to the rear of the properties and restrict views for both floors. Oblique views of Manrahead Roundabout to the southeast may be experienced through gaps in the vegetation.

8.3.40 Properties 1 and 3 McMillan Crescent are located to the northeast of Manrahead Roundabout. The semi-detached dwellings experience oblique views of Manrahead Roundabout to the southwest and oblique views of the A737 to the south east.

8.3.41 The sensitivity of this receptor is determined to be high.

Visual receptor 13

Properties 5, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52 McMillan Crescent

8.3.42 McMillan Crescent is a residential area situated to the northeast of Manrahead Roundabout. Properties 5-52 are two storey semi-detached dwellings, the majority of which lie adjacent to the existing A737 carriageway. To the southeast of the properties there is a steep embankment which raises the A737 slightly above the dwellings. A safety barrier runs along the road at this point and trees and vegetation are present on the embankment. The lower floors of the properties have restricted views of the A737 looking southeast due to screening from the existing embankment and vegetation. The upper floors experience clearer views of the road. Photograph 8.15 illustrates the view of the properties from the proposed A737 alignment. The sensitivity of this receptor is determined to be high.

Photograph 8:15: View of properties on McMillan Crescent looking northeast

<u>Visual receptor 14</u>

Properties 46–57 Grahamfield Place and 46 Balfour Avenue

8.3.43 Grahamfield Place is a new housing development which lies to the northwest of the existing A737. Properties 46-57 are detached two storey dwellings constructed from brick. The A737 rises as it passes this residential area and a wooden fence approximately 1.5m high blocks views of the road for properties 51-57. The remaining properties experience limited or oblique views of the A737 to the south and west. Balfour Avenue lies immediately adjacent to Grahamfield Place and property 46 is a detached two storey dwelling. Views from this receptor are similar to those on Grahamfield Place. Photograph 8.16 illustrates views of the properties from the existing A737. The sensitivity of this receptor is determined to be high.

Photograph 8:16: View of Grahamfield Place looking north

Visual receptor 15

Properties 8, 10, 12, 14 Glebelands Way

8.3.44 Glebelands Way is a residential area located to the northwest of the A737. The properties at this location are of a mix of detached and semi-detached dwellings. Properties 8-14 are two storey, detached dwellings which have elevated views of the existing A737 and farmland from their upper rear floors looking south. The A737 rises slightly at the point where it passes behind the properties and a wooden fence, approximately 2m high, separates the carriageway and properties gardens. As a result, the lower floors of the properties do not experience any views of the A737, while the upper floors experience direct elevated views. A line of Lawson's cypress *Chamaecyparis lawsoniana* is present to the rear of properties 11 and 12 which limit their view of the road. Photograph 8.17 shows the properties from the approximate centre line of the proposed A737. The sensitivity of this receptor is determined to be high.

Photograph 8:17: View of 8-14 Glebelands Way looking northwest

Visual receptor 16

Amenity grass area, Glebelands Way

8.3.45 An amenity grass area lies at the western extent of Glebelands Way, between properties 27 and 29. Two footways run either side of this area and lead north into the residential areas located behind Glebelands Way. Both the grass area and footways have a view of the existing A737 looking south, screened slightly by the presence of deciduous trees and a sparse beech hedge which lie adjacent to the carriageway. Photograph 8.18 shows the grass area looking northeast. The sensitivity of this receptor is determined to be moderate as it is a recreational space yet is not utilised for enjoyment of the surrounding countryside.

Photograph 8:18: View of grass area and properties on Glebelands Way looking northeast

Visual receptor 17

Properties 27, 29, 31, 33, 35, 37, 39, 40, 41, 43, Glebelands Way and 40, 40a, 46 Glebe Road

8.3.46 Properties 27-46 are a mix of detached and semi-detached dwellings located on Glebelands Way and Glebe Road. Glebe Road is a residential area which lies to the northeast of Glebelands Way. A grass embankment containing deciduous trees and vegetation separates the properties on Glebelands Way, Glebe Road and the A737 at this point. The properties have restricted views of the A737 looking southeast due to the existing vegetation. Views of the A737 will be clearer in winter and restricted in summer when the trees are in leaf. Photograph 8.19 illustrates the view of the properties from the approximate centre line of the proposed A737 alignment. The sensitivity of this receptor is determined to be high.

Photograph 8:19: View of properties Glebelands Way looking northwest

Visual receptor 18

Properties 42, 42a, 44 and 58 Glebe Road

8.3.47 At the northeast extent of Glebelands Way on Glebe Road lie properties 42, 42a and 44. Properties 42 and 42a are detached bungalows which are separated from the A737 by a slight embankment which hosts limited vegetation. The properties are slightly elevated and experience views of the A737 looking southeast. A hedge approximately 2m high restricts views of the existing carriageway slightly for the lower floors of property 42a. Velux windows are set into the roof of this bungalow and will offer elevated views of the road. Property 42 lies to the west of 42a and experiences clear views of the A737 due to a lack of vegetation in front of the property. A Velux window in the roof of this property will also provide views of the road. Photograph 8.20 illustrates the view of the properties from the approximate centre line of the proposed A737.

8.3.48 44 Glebe Road is situated to the immediate southwest of properties 42 and 42a and is a two storey detached property. Tall deciduous trees and vegetation lie to the front of the property and restrict views of the A737 and landscape looking southeast. Gaps in the vegetation however will provide elevated views of the A737 looking east.

8.3.49 58 Glebe Road sits immediately behind properties 42 and 42a to the northwest of the existing A737. Property 58 is a detached bungalow and currently holds views of the A737 looking east. This view is restricted slightly by the presence of vegetation in the property's garden.

8.3.50 The sensitivity of this receptor is determined to be high.

Photograph 8:20: View of 42 and 42a Glebelands Way looking north

<u>Visual receptor 19</u>

Properties 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43 Barrmill Road

8.3.51 The properties on Barrmill Road are a mix of detached and semi-detached stone constructed properties with pitched slate roofs. Properties 27–43 at the southern extent of Barrmill Road are semi-detached dwellings with large bay windows which provide clear views of the A737 to the east. A grass area lies opposite properties 31-35 and contains semi-mature trees which restrict views of the A737 slightly. Properties 13-31 will experience oblique views of the A737 looking southeast. Photograph 8.17 illustrates the view of Barrmill Road from the proposed Barrmill Road alignment. The sensitivity of this receptor is determined to be high.

Photograph 8:21: View of Barrmill Road looking west

Visual receptor 20

Properties 10a, 10b, 10c 10d, Barrmill Road

8.3.52 Similar to visual receptor 19, properties 10a-10d lie on Barrmill Road and are detached, stone constructed dwellings which lie to the north of the existing A737 carriageway. The properties experience restricted views of the A737 from their rear windows looking northeast and oblique views of Barrmill Road to the southwest. Deciduous trees are present to the rear of the properties which screen views of the A737 slightly. The sensitivity of this receptor is determined to be high.

Visual receptor 21

Properties 2- 76 Larch Terrace

8.3.53 Larch Terrace runs immediately to the west and northwest of the existing A737. It contains residential properties on one side of the road and public open space on the other. The properties are two storey terraced dwellings constructed from brick. The majority of properties have small private gardens to the front and their boundaries consist of hedgerow, stone walls and wooden fencing. The area of open space

immediately opposite the properties hosts a selection of mature deciduous trees, primarily along the boundary to the A737. Tree species include ash *Fraxinus excelsior*, alder *Alnus glutinosa*, sycamore , poplar *Populus spp* and cherry *Prunus avium*. All of the properties on Larch Terrace will experience a direct view of the A737 in winter and screened views in the summer when trees are in leaf. Photograph 8.22 shows the properties from the approximate centre line of the proposed Head Street Roundabout. The sensitivity of this receptor is determined to be high.

Photograph 8:22: View of Larch Terrace looking southwest

Visual receptor 22

1a, 2a, 3a, 4a Rowan Avenue and 45, 47, 49, 51, 54, 56, 58, 60 Montgomery Avenue

8.3.54 Rowan Avenue and Montgomery Avenue run perpendicular to Larch Terrace and host two storey, terraced dwellings. A number of properties on both avenues experience restricted views of the A737 looking east and oblique views of the road looking northeast and southeast. Views are obstructed slightly due to the presence of deciduous trees and vegetation within the open space opposite Larch Terrace. As a result, the properties have clearer views of the A737 in winter and more restricted views in summer when the trees are in leaf. The sensitivity of this receptor is determined to be high.

Visual receptor 23

Children's play park, Larch Terrace

8.3.55 A children's play area is located to the east of Larch Terrace directly opposite the residential properties. The area contains of a double set of senior swings, one junior set of swings, a seesaw and chute, all of which are installed on a polymeric surface. A small football area with a set of goal posts is situated to the south of the site as well as a public telephone box. The play area experiences similar views of the existing A737 to the properties on Larch Terrace; clear views in the winter and restricted views in the summer due to the presence of deciduous trees and vegetation. Photograph 8.23 illustrates the view of the play area looking northeast towards the A737. The sensitivity of this receptor is determined to be high as the play park's main recreational purpose is the enjoyment of the outdoors.

Photograph 8:23: View of play park looking northeast

Visual receptor 24

Properties 1–12 Wardrop Terrace, 1-2 Wardrop Street and 32, 34, 36 and 55 Head Street

8.3.56 Wardrop Terrace is a residential area situated on Head Street to the immediate west of the A737. Properties 1-12 are cottage flats with painted and unpainted render. Stone walls approximately 1m in height determine their boundary with the footway on Head Street. Properties 11 and 12 experience direct views of the A737 due to their eastward facing windows. The remaining properties on Wardrop Terrace have oblique views of the A737 looking southeast. Properties 1 and 2 Wardrop Street lie directly opposite the properties on Wardrop Terrace and are semi-detached dwellings. Property two has a direct view of the existing A737 looking east, while property one has an oblique view of the road looking northeast. Properties 32-55 are semi-detached dwellings which lie on Head Street. The properties currently experience direct views of Head Street and oblique views of the A737. Photograph 8.24 illustrates the view of the properties on Wardrop Terrace from the centre line of the proposed Head Street Roundabout. The sensitivity of this receptor is determined to be high.

Photograph 8:24: View of Wardrop Terrace looking northwest

Visual receptor 25

Properties 2, 4, 6, 8, 10 Aitken Drive

8.3.57 This residential area lies to the west of the A737 to the north of Head Street. The properties are two storey detached dwellings constructed from brick with pitched tiled roofs. Garages are attached to the gable end of the properties and each property has a small front and rear secluded garden. The rear of the properties face east towards the existing A737 and a wooden fence, approximately 1.5m high, delineates the boundary of the properties to the rear. As a result, the lower floors experience limited or no views of the A737, while the upper floors have direct, elevated views looking east. Beyond the A737 to the east, the properties experience views of open farmland. Photograph 8.25 illustrates the view of Aitken Avenue from the proposed A737 alignment. The sensitivity of this receptor is determined to be high.

Photograph 8:25: View of Aitken Avenue looking west

Visual receptor 26

Thomson of Beith

8.3.58 This commercial property lies on the roadside of the A737 to the immediate west of the carriageway. It consists of a garage forecourt with shop, car wash and repair facilities. The premises have a direct, unobstructed view of the A737 looking east and an oblique view of Wardrop Street. Beyond the A737 to the east, the property has screened views of farmland due to vegetation. Photograph 8.27 illustrates the view of Thomson of Beith from the approximate alignment of the proposed A737. The sensitivity of this receptor is determined to be low; viewers from this receptor will only be present in the property part time and currently experience clear views of road space.

Photograph 8:26: View of Thomson of Beith looking west

Visual receptor 27

Properties 14, 16, 18, 20, 22, 24, 26, 28, 30, 32 and 71 Aitken Avenue

8.3.59 Similar to visual receptor 24, the residential properties at this point on Aitken Avenue are two storey detached dwellings. An area of amenity grassland separates the rear gardens of the properties and the A737. A wooden fence approximately 1.5m high designates the boundary of the properties with the grassland. There are limited or no views of the existing A737 from the lower floors of the properties, yet elevated distant views from the upper floors. The sensitivity of this receptor is determined to be high.

Visual receptor 28

Properties 11–39, Crummock Gardens and Birchbank, Bigholm Road

8.3.60 This is a residential area located immediately west of the A737 to the north of Thomson of Beith. The properties within this area are semi-detached, two storey dwellings which face directly onto the A737 looking east. A stone wall lies in front of properties 11-26 which restrict views for the lower floors. The upper floors however experience direct elevated views of the road looking east. Properties 30-39 have direct uninterrupted views

of the road looking east from both floors. Birchbank is a detached residential property which lies slightly north of Crummock Gardens on Bigholm Road. The property is surrounded by tall trees and vegetation which restricts its views in all directions. A small gap in the vegetation provides limited views of the existing A737 for this receptor looking southeast. Photograph 8.27 illustrates the view of properties 17-26 from the existing A737. The sensitivity of this receptor is determined to be high.

Photograph 8:27: View of Crummock Gardens looking west

Visual receptor 29

Views from the Road, A737

8.3.61 The A737 is predominantly used by motorists, pedestrians and equestrians. A footway runs along the western edge of the road for the entire scheme extents. Travelling north from Manrahead Roundabout, there are intermittent views to the east of the carriageway of agricultural land interspersed with woodland and clusters of hedgerow. Electricity pylons can also be viewed in the distance in this direction. Tall trees on the roadside restrict views outwards at points along the carriageway. Views open slightly as the road travels north past Wardrop Street. To the west of the carriageway, road users experience restricted views due to residential properties within Beith. There are few

features of particular interest or value along the route; Spier's Old School Grounds can be viewed to the east of the carriageway within the southern extent of the route. The sensitivity of this receptor is determined to be low; following recommendations in IAN 135/10, the users of main trunk roads are determined to be of low sensitivity.

Visual receptor 30

Views from the Road, Wardrop Street

8.3.62 Wardrop Street is currently used by motorists, pedestrians and equestrians. A footway runs along the northern edge of the road from the A737 junction to the neighbouring village of Gateside. Travelling from Netherhill to the A737 junction, there are open views of poor quality agricultural land to the north and south, and open views of residential properties within Beith to the west. A stone wall runs along the northern edge of the road which contributes to the quality of the view. There are few features of particular interest or prominence within the view. The sensitivity of this receptor is determined to be low.

Visual receptor 31

Views from the Road, Geilsland Road

8.3.63 Geilsland Road is currently utilised by motorists, pedestrians and equestrians. The road is a single track and no footway is provided for pedestrians. Similar to Wardrop Street, there are open views of agricultural land to the north and south of the road when travelling towards the A737 junction. Woodland within Spier's Old School Grounds is a noticeable feature of the view looking south. Travelling west towards the A737 there are restricted views due to residential properties within Beith. The sensitivity of this receptor is determined to be low.

Visual receptor 32

Views from the Road, Barrmill Road

8.3.64 Barrmill Road is predominantly used by motorists and pedestrians. A small footway runs along the eastern edge of the road from the A737 junction to Spier's Old School Grounds and beyond. Travelling north along the road from Spier's Old School Grounds there are open views to the west of high quality agricultural land, interspersed with small clusters of woodland and hedgerow. Electricity pylons are visible in this direction. At the southern end of the route, views to the east are blocked by mature woodland within Spier's Old

School Grounds. At the northern extent towards the A737/Barmill junction there are restricted views to the north due to residential properties located within Beith. The sensitivity of this receptor is determined to be low.

8.4 Landscape impact assessment

8.4.1 Impacts on landscape are considered for both the construction and operation phases of the scheme.

Temporary impacts during construction

8.4.2 Impacts on the landscape due to the contractor's operations will be temporary and it is important that as far as possible, no impacts continue after the duration of the contract. The construction phase of the scheme will involve a number of activities that will impact upon landscape. The main issues include:

- The establishment of construction compounds, haul roads, security fencing and temporary working areas
- The visual intrusion of traffic management and associated traffic queues
- Restricted access to roads, Public Rights of Way, residential and commercial properties
- Earthworks and the stockpiling of material which may be visually intrusive and lead to damage to trees, vegetation and underlying soil surfaces
- Reduced tranquillity and visual amenity of the landscape due to noisy work processes and the presence of Heavy Goods Vehicles (HGVs), plant and artificial site lighting.

8.4.3 The magnitude of impact and significance of impacts during the construction phase for landscape are assessed using Table 8.2 and Table 8.5 respectively. The landscape elements assessed as moderate impact significance or above are considered to be significant on a temporary basis. Both the magnitude of impacts and impact significance for construction are summarised in Table 8.9.

Landscape character

8.4.4 Construction activities will be limited to the area surrounding the A737 at Beith and as a result, impacts upon the wider North Ayrshire region will be limited. Temporary land take from agricultural land will be required however this will be insignificant on a regional scale. Accordingly, it is considered that the regional landscape will experience a

negligible impact magnitude during construction, resulting in an impact significance of slight adverse.

8.4.5 On a local scale, land immediately surrounding the scheme will be required for construction compounds, welfare facilities and for the storage of machinery and materials. Earthworks will also be a large element of construction. As a result, there will be noticeable damage to the existing local landscape throughout the construction period. A moderate adverse impact magnitude is determined for the local landscape, resulting in impact significance of moderate adverse.

8.4.6 The following paragraphs describe the impacts on each local landscape element during construction.

Landcover, pattern and texture

8.4.7 As discussed, during construction land adjacent to the scheme will be utilised for contractor's compounds, welfare facilities and for the storage of machinery, plant and materials. Haul roads will further be created on land surrounding the scheme to aid the construction process. Construction elements such as this will disrupt the pattern and texture of the land. As a result, a moderate adverse magnitude of impact is determined for landcover, pattern and texture, resulting in impact significance of moderate adverse.

Scale and appearance

8.4.8 Similar to landcover pattern and texture, the presence of contractor's compounds, welfare facilities and the storage of machinery, plant and materials will temporarily change the appearance of the landscape. Temporary structures such as construction compounds and contractor's welfare will not fit with the surrounding landscape, which is currently dominated by agricultural land and rural residential dwellings. Machinery and plant will have a constant presence on site which will adversely impact the appearance of the landscape. Machinery such as HGV's, diggers and cranes will disturb views and skylines until the construction phase is complete. A moderate adverse impact magnitude is determined for scale and appearance, resulting in impact significance of slight adverse.

Tranquillity

8.4.9 As discussed in paragraph 8.5.8, construction machinery will have a constant presence on site and the movement and operation of these vehicles will likely increase levels of noise and vibration within the area. Work processes such as excavations will further contribute to levels of noise and vibration and will potentially lead to a slight decrease in

air quality due to the generation of dust. Traffic management will be in place throughout the construction phase which will result in slower moving traffic and subsequent traffic queues. As a result, a moderate adverse impact magnitude is determined for tranquillity, resulting in slight adverse impact significance.

Cultural

8.4.10 Impacts on cultural heritage will be limited during construction. The presence of construction compounds and the creation of haul roads will temporarily impact field sizes which will change the character of the existing landscape. As a result, a moderate adverse impact magnitude is determined for cultural, resulting in slight adverse impact significance.

Human interaction

8.4.11 The construction phase will disrupt how the local population interact with the landscape. Pedestrians and equestrians will face disruptions due to route closures and diversions along the A737, Wardrop Street, Barrmill Road and Geilsland Road. Motorists utilising these roads will also be impacted by traffic management and associated traffic queues. More information on this particular impact is available in Chapter 13 Effects on all Travellers. Land adjacent to the scheme will host construction compounds, machinery and materials which will temporarily prevent local landowners from fully utilising their land. As a result, a moderate adverse magnitude of impact is determined for human interaction, resulting in slight adverse impact significance.

Permanent impacts post construction (without mitigation)

8.4.12 Post construction, the scheme will be completed and the visually intrusive elements of the construction phase will no longer be present in the study area. As discussed in paragraph 8.2.16 no mitigation measures will be in place at this point. The character of the local landscape will be impacted by the following:

- The proposed new road alignments and associated road infrastructure (eg new street lighting, road signage, safety barriers and fencing)
- The creation of Barrmill Roundabout, Head Street Roundabout and the subsequent removal of two junctions
- The loss of agricultural land to the east and southeast of the A737

- The removal of woodland, grassland and other vegetation along the proposed new road alignments
- The removal of boundary treatments including stone walls and hedgerow
- The creation of four Sustainable Urban Drainage Systems (SuDS) basins
- Changes to the natural topography of the landscape due to the creation of embankments and cuttings
- The creation of an elevated footbridge over the proposed A737

8.4.13 The magnitude of impact and the significance of impact of the scheme are assessed using Tables 8.2 and 8.5 respectively. Table 8.9 summaries the permanent impacts on landscape post construction prior to mitigation.

Landscape character

8.4.14 The scheme will have a limited impact on the regional landscape post construction. The new road alignments will require permanent land take and the removal of woodland, hedgerow and vegetation. This site clearance however is unlikely to impact the character of the landscape on a regional scale. Subsequently, a negligible adverse magnitude of impact is determined for the regional landscape, resulting in an impact significance of slight adverse.

8.4.15 On a local scale, the proposed road alignments and the creation of two large roundabouts will impact the landscape character. The scheme will result in the loss of agricultural land to the east and southeast of the A737 as well as the removal of landscape features. Changes to the natural topography of the land will also incur. The loss of such features will be immediately perceptible and will permanently change the local landscape character. As the landscape is deemed to have moderate sensitivity, a significant impact will be experienced. A moderate adverse impact magnitude is determined for the local landscape, resulting in an impact significance of moderate adverse.

8.4.16 The impact on each local landscape element is outlined in the following paragraphs.

Landcover, pattern, texture

8.4.17 The proposed road alignments and roundabouts at Barrmill Road and Head Street will result in adverse impacts for landcover, pattern and texture. The new A737 will be wider in the landscape and will require land take from farmland to the east and southeast of

the existing carriageway. Subsequently, woodland, hedgerow and other vegetation along the proposed route will be removed. Further areas of grassland will also be lost during the realignment of Wardrop Street, Barrmill Road and the creation of the two roundabouts. The natural topography of the land will be disturbed, particularly at the proposed Barrmill Roundabout where the land will be levelled and drained. The existing pattern of the land will further be impacted by the removal of two junctions and approximately 130m of Geilsland Road. A moderate adverse impact magnitude is determined for landcover, pattern and texture post construction, resulting in an impact significance of moderate adverse.

Scale and appearance

8.4.18 As discussed, site clearance will be required to accommodate the scheme. The proposed A737 will cut through land which is currently open farmland and as a result, woodland, hedgerow and shrub along the new route will be lost. The road will sever fields to the southeast of the existing A737 and disturb their natural pattern. The creation of embankments and cuttings will further disturb the natural pattern of the landscape. As a result, a moderate adverse magnitude of impact is determined for scale and appearance, resulting in an impact significance of slight adverse.

Tranquillity

8.4.19 The modification of the existing A737 and Barrmill Road into a shared footway and cycleway will enhance the tranquillity of the area post construction. However, the A737 will remain the dominant feature of the landscape and the proposed Barrmill Road alignment will move the road closer to Spier's Old School Grounds, disturbing tranquillity within the rural urban fringe As a result, a minor adverse magnitude of impact is determined for tranquillity, resulting in an impact significance of negligible adverse.

Cultural heritage

8.4.20 Post construction there will be a loss of a landscape features which contribute to the local historic environment. The stone walls which run along either side of Wardrop Street will be removed to accommodate the new alignment of Wardrop Street, while the new alignment of the A737 will result in the severance of fields and the loss of woodland and hedgerow. The natural field boundaries will be lost and field sizes will reduce. A moderate adverse magnitude of impact is therefore determined for cultural heritage post construction, resulting in an impact significance of slight adverse.

Human interaction

8.4.21 The modification of the existing A737 carriageway into a footway and cycleway will improve recreational opportunities for pedestrians, cyclists and equestrians post construction. The provision of the new pedestrian footbridge will further improve access for pedestrians and cyclists wishing to access Beith. The new alignment of the A737 will however lead to the severance of Barrmill Road which will subsequently lead to increased journey times for some pedestrians wishing to access Spier's Old School Grounds and the surrounding countryside. This impact is considered minimal however as journey times over the diverted footpath will only increase slightly; further information on this impact is available in Chapter 13 All Travellers . As a result, a moderate beneficial impact magnitude is determined for human interaction post construction resulting in slight beneficial impact significance.

Table 8.9: Summary of landscape impacts

Landscape feature	Sensitivity	Impact During construction		Impact Post construction	
		Magnitude	**Significance**	**Magnitude**	**Significance**
Regional landscape	Low	Negligible adverse	Slight adverse	Negligible adverse	Slight adverse
Local landscape	Moderate	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
Landcover, pattern and texture	Moderate	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
Scale and appearance	Low	Moderate adverse	Slight adverse	Moderate adverse	Slight adverse
Tranquillity	Low	Moderate adverse	Slight adverse	Minor adverse	Negligible adverse
Cultural	Low	Moderate adverse	Slight adverse	Moderate adverse	Slight adverse
Human interaction	Low	Moderate adverse	Slight adverse	Moderate beneficial	Slight beneficial

8.5 Landscape mitigation

During construction

8.5.1 The adverse impacts of the construction phase cannot be removed completely, however mitigation measures will be implemented to reduce their impact and to ensure they do not give rise to permanent impacts. The following measures will be implemented to reduce impacts on landscape:

- All landscape work will be supervised by a Chartered Landscape Architect and/or Landscape Clerk of Works (LCoW)
- The contractor's compound will be chosen to avoid undue visual intrusion and damage to underlying soils
- Construction vehicles will be stored in visually unobtrusive areas when not in use and not left in areas where soils and vegetation will be damaged
- Artificial site lighting will be planned to minimise light spillage into adjacent areas
- Waste materials will not be stockpiled and will be removed from site as soon as possible
- Haul roads will be sited where minimum site clearance is required
- Where significant specimen trees are to be retained within the scheme extents in close proximity to the construction works, Root Protection Areas (RPA) will be calculated and established in accordance with BS5837: 2012 Trees in relation to design, demolition and construction – Recommendations. The protection areas will be adhered to and no plant, machinery or construction materials will be stored within these areas.
- The disposal of any ash *Fraxinus* species will be in accordance with guidance to prevent the spread of ash dieback *Chalara fraxinea*. Ash dieback is a disease of ash trees caused by a type of fungus called *Hymenoscyphus fraxineus.* The Forestry Commission and the Scottish Environment Protection Agency will be consulted for the disposal methods.

Post construction

8.5.2 The following mitigation measures will be implemented to reduce impacts on landscape post construction:

- The loss of mature trees will be remedied by replacement planting of semi-mature trees of a similar species on a 2:1 replacement basis. Ash trees will be avoided due to concerns over ash die back
- Cuttings and embankments should be created as naturally as possible through appropriate grading and shaping
- Similar tree and shrub species found in the surrounding landscape will be used to assist in the assimilation and integration of the scheme. Opportunities will be created to add visual interest whilst improving landscape quality and enhancing biodiversity. Where possible, native planting will be of local provenance to ensure successful establishment
- Where boundary treatments are removed to accommodate the scheme, the treatments will be reinstated using similar materials
- The stone walls which run along Wardrop Street will be reinstated along the proposed Wardrop Street alignment. The existing stone will be re-used and if additional material is required, stone which ties into the existing landscape will be used
- Ground surfaces will be made good using a similar ground surface treatment. Areas of new grassland will be planted with native species to enhance biodiversity and indigenous seed should be sourced locally to allow embankments to be vegetated. Wildflower seeds will be incorporated into the seed mix
- New hedgerows will be planted in patterns that complement the existing landscape. A range of native hedgerow species will be used to enhance biodiversity and improve visual amenity
- Fragmented open space as a result of the scheme will be landscaped and planted to enhance a sense of place
- Trees will be strategically planted on the embankments surrounding the proposed footbridge over the A737 to integrate the structure into the landscape
- Field fragmentation will be mitigated through the reinstatement and/or creation of field boundaries such as fencing and hedgerow. This will be dependent on land ownership. New boundaries will be in keeping with the existing boundaries and the affected landowners will be consulted

- New fencing will be installed around each of the four SuDS basins. Where possible, the fencing will flow around the basins and linear patterns avoided
- The planned mitigation to reduce impacts on landscape post construction is illustrated in the Landscape Proposals, as shown in Drawing 25000199/100/166
- Ornamental, native shrub and bulb planting will take place close to the new roundabouts to create seasonal interest and positive visual amenity.

8.6 Landscape residual impacts

8.6.1 The residual impact is the expected impact of the scheme with the aforementioned mitigation in place and successful when seen in winter after one year of operation, which is considered to be the worst case, and in summer after fifteen years of operation, which is considered to be the best case scenario.

Year 1 (Winter)

8.6.2 The residual impact magnitude and impact significance for landscape are determined using Tables 8.2 and 8.5 respectively. The residual impacts for landscape in year 1 are summarised in Table 8.10.

8.6.3 In year one, the mitigation planting outlined within the landscape design will be immature and will not have developed sufficiently to integrate the scheme into the surrounding landscape. Re-planted hedgerow will not contribute to the landscape character and areas of newly sown grassland will not have developed into a dense sward. New road infrastructure will remain emphasised within the landscape. As a result, it is determined that the impact significance for the regional landscape will remain as slight adverse in year one after opening. The impact significance for the local landscape will remain as moderate adverse.

8.6.4 The impact significance for the majority local landscape features will also remain the same as post construction. Only cultural heritage will experience a change in impact significance in year one after opening. This is due to the reinstatement of the stone walls along the proposed alignment of Wardrop Street. The impact significance will lessen from slight adverse in the post construction phase to neutral in year one after opening.

Year 15 (Summer)

8.6.5 After 15 years of operation, mitigation planting will have established successfully and the scheme will have integrated into the local landscape. Replanted woodland will have matured and areas of new vegetation will have fully developed. Grassland will be reinstated and areas of wildflower will have established. Hedgerows will have matured to a point where they contribute to the local landscape character. Table 8.10 summarises the residual impacts for landscape in year 15.

8.6.6 It is determined that the impact significance for the regional landscape in year 15 is slight adverse as there remains an overall loss of agricultural resource. This impact however will remain insignificant at a regional scale.

8.6.7 For local landscape, it is determined that the impact significance will reduce from moderate adverse in year 1 to slight adverse in year 15 due to the successful establishment of mitigation planting. There will however, remain an overall loss of landcover due to the land take required for the proposed alignments. Further, the proposed Barrmill Road will remain closer to Spier's Old School Grounds; a tranquil area which is frequently used by local residents for recreational purposes. As a result, the impact significance for landcover and tranquillity is determined to be slight adverse and negligible adverse respectively. A slight beneficial impact significance is determined for scale and appearance due to improvements in the quality of the areas woodland and vegetation as a result of the mitigation planting.

8.6.8 The impact significance for human interaction and cultural heritage will remain the same as year 1.

Table8.10: Summary of landscape residual impacts

Landscape element	Sensitivity	Residual impact year 1 (Winter)		Residual impact year 15 (Summer)	
		Magnitude	Significance	Magnitude	Significance
Regional landscape	Low	Negligible adverse	Slight adverse	Negligible adverse	Slight adverse
Local landscape	Moderate	Moderate adverse	Moderate adverse	Minor adverse	Slight adverse
Landcover, pattern and texture	Moderate	Moderate adverse	Moderate adverse	Negligible adverse	Slight adverse
Scale and appearance	Low	Moderate adverse	Slight adverse	Minor beneficial	Slight beneficial
Tranquillity	Low	Minor adverse	Negligible adverse	Minor adverse	Negligible adverse
Cultural	Low	No change	Neutral	No change	Neutral
Human interaction	Low	Moderate beneficial	Slight beneficial	Moderate beneficial	Slight beneficial

8.7 Visual impact assessment

8.7.1 Impacts on visual receptors are considered for both the construction and operation phases of the scheme. Impacts for both phases are summarised within the Visual Impact Schedule illustrated in Appendix 8.1. The location of each visual receptor is illustrated in Figure 8.2 Visual Effects Drawing.

Temporary impacts during construction

8.7.2 The construction activities described in paragraph 8.5.2 will adversely impact all of the visual receptors listed within the ZVI (Figure 8.1). The magnitude of impact for each visual receptor is determined using Table 8.4, while the significance of impacts is determined using Table 8.5. Both the magnitude of impacts and significance of impacts during the construction phase are summarised in Table 8.11. The receptors assessed as moderate impact significance or above are determined to be significantly impacted on a temporary basis.

8.7.3 Receptors 4, 5, 7, 8, 9, 10, 24 and 28 will experience the largest adverse impact during construction due to their proximity to the scheme. These are residential receptors which are located within several metres of the proposed improvements and as a result, will experience direct views of the construction work and traffic management. The receptors will be affected by an impact of major impact magnitude, resulting in very large adverse impact significance.

8.7.4 Receptors 12, 19, 20, 21 and 22 are further residential properties which lie within close proximity to work and will experience direct and oblique views of the construction work. The receptors will be affected by an impact of major adverse magnitude, resulting in large adverse impact significance

8.7.5 Receptors 1, 3, 6, 11, 13, 17, 18, 23, 25, 26, 27 and 29-32 will also experience a significant adverse impact during the construction phase, yet will have slightly restricted views of the construction work due to screening from trees, vegetation, building frontages and the topography of the landscape. The position of the receptors in relation to the construction work will further result in many holding oblique views. While views of the scheme may be screened or oblique, the presence of moving machinery, traffic management and traffic queues will likely extend construction into the view of the receptors. The impact magnitude for these receptors is determined to be minor or moderate adverse, yet all will be affected by a moderate adverse impact significance.

8.7.6 Receptors 2, 14, 15, 16 will not experience a significant impact during construction, primarily due to their distance from the work and screening from vegetation and boundary treatments. The magnitude of impact for these receptors is determined to be minor or negligible adverse, yet all result in slight adverse impact significance.

8.7.7 The receptors to be significantly impacted during the construction phase are therefore; 1, 3-13 and 17-32.

Permanent impacts post construction (without mitigation)

8.7.8 Post construction, the scheme will be completed and the visually intrusive elements of the construction period will no longer be present in the study area. The permanent visual impacts associated with the scheme post construction will be caused by:

- The completed new road alignments; A737, Barrmill Road and Wardrop Street
- Creation of Barrmill Roundabout and Head Street Roundabout
- Loss of farmland to the east and southeast of the existing A737
- Removal of trees, hedgerow and vegetation along the proposed alignments
- Loss of boundary treatments, including stone walls along Wardrop Street
- Formation of cuttings and embankments
- Addition of new road signage, street lighting, fences and barriers
- Modification of the existing A737 carriageway into a shared footway and cycleway
- Creation of an elevated footbridge over the proposed A737 hosting a shared cycleway and footway.

8.7.9 The impact magnitude and impact significance for visual receptors post construction without mitigation in place are assessed using Tables 8.4 and 8.5 respectively. The results are summarised in Table 8.11.

8.7.10 Receptors 7, 8, 9 and 10 will experience the largest adverse impact post construction as the scheme will become the dominant feature of their views. The receptors are residential properties situated within close proximity to one another on Barrmill Road and Spiersland Way. The proposed A737 alignment will run immediately adjacent to the receptors through land which is currently open farmland. Barrmill Roundabout will also be created to the northeast of the receptors within this open land. As a result, the receptors will lose views of open land which will be replaced with views of road space. New street lighting on the proposed Barrmill Roundabout will be immediately perceptible

from the receptors. Receptors 7 and 8 currently experience clear views of agricultural land and woodland to the northeast of their properties; this view will be completely lost post construction due to the creation of Barrmill Roundabout. Similarly, receptors 9 and 10 currently experience clear views of agricultural land to the northeast, west, northwest and southwest of their properties. Their views post construction will be dominated by the proposed A737 and Barrmill Roundabout. As a result, the receptors will be affected by an impact of major impact magnitude resulting in very large adverse significance.

8.7.11 Receptors 5 and 24 are residential receptors which lie on Wardrop Street and Wardrop Terrace, both within several metres of the proposed Wardrop Street alignment and Head Street Roundabout. Views from the properties post construction will be dominated by the improvements. Receptor 5 will experience clear views of the scheme to north and oblique views to the northwest and southwest. The creation of Head Street Roundabout will move the A737 several metres closer to this receptor and the realignment of Wardrop Street will include the removal of stone walls which the receptor currently has clear views of to the north. New street lighting will be installed on the proposed Head Street Roundabout and along the new alignment of Wardrop Street. This will result in major deterioration to views from the properties at this point. Receptor 24 will have clear views of the scheme to the east and oblique views to the northeast and southeast. While both receptors currently experience views of the existing A737 and Wardrop Street, the proposed improvements will immediately stand out within the landscape post construction due to a lack of mitigation. The proposed roundabout at Head Street will create slower moving traffic at this point of the A737 which will be perceptible from the properties. New road infrastructure including new ground surfaces and road signs will further impact views, while the addition of new street lighting will adversely impact all of the properties at this point. As a result, the receptors are determined to have a major adverse impact magnitude, resulting in large impact significance.

8.7.12 Receptors 4, 11, 12, 19 and 25 are the remaining receptors which will experience a significant adverse impact post construction. The receptors have been assessed as having either a minor or moderate impact magnitude, yet all result in moderate adverse impact significance. Receptor four is situated on Wardrop Street and will have views of the scheme to the northwest and southwest. The removal of stone walls along Wardrop Street will adversely impact views from this property to the north. Receptor 11 is a residential property which lies to the southeast of Manrahead Roundabout. It will experience clear views of the scheme to the northwest. The improvements will move the

existing Manrahead Roundabout and the A737 several metres closer to the property, which will lead to an obvious deterioration in views from the receptor looking northwest. Similar to this, receptor 12 is a residential cluster located slightly north of Manrahead Roundabout. The properties at this location will have a mix of clear and oblique views of the scheme looking south, southwest and southeast. Views will be disrupted due to the presence of new road infrastructure and the creation of a SuDS basin. Receptor 19 is a further residential cluster on Barrmill Road. The properties will experience clear views of the scheme looking east and oblique views looking southeast. Barrmill Roundabout will be created to the east of the properties which will result in the properties losing views of open agricultural land. The proposed Barrmill Road alignment will also run to the immediate east of the properties which will result in land take from an existing area of grassland which currently hosts a small line of trees. This will lead to an obvious deterioration in views looking east. Receptor 25 is a line of residential properties located on Aitken Avenue. The properties will have direct, elevated views of the scheme from their upper floors looking east and will experience perceptible damage to their views due to the addition of new street lighting.

8.7.13 The remaining visual receptors within the ZVI are determined to experience either a slight adverse impact or a beneficial impact post construction. Receptors 1, 2, 3, 6, 26, 27, 28, 29, 30, 31, 32 will experience slight adverse impact significance, primarily due to disruptions to their views due to the removal of landscape features and/or the proposed A737 alignment moving the road slightly closer to the receptors. Areas of soil yet to be landscaped will also create an adverse visual impact for the receptors.

8.7.14 Receptors 13, 14, 15, 17, 18 and 20-23 will experience significant beneficial impacts post construction due to the proposed A737 moving further away from the properties. As a result, there will be reduced views of vehicles for these receptors. The modification of the existing carriageway into a footway and cycleway will further improve views for the properties.

8.7.15 Eleven visual receptors will therefore experience a significant adverse impact post construction; receptors 4, 5, 7 - 12, 19, 24 and 25.

Table 8.11: Summary of visual impacts

Visual receptor		Sensitivity	During construction (without mitigation)		Post construction (without mitigation)	
			Magnitude of impact	**Significance of impact**	**Magnitude of impact**	**Significance of impact**
1	Crummock Farmhouse	High	Minor adverse	Moderate adverse	Negligible adverse	Slight adverse
2	Farmhouse Hill of Beith	High	Negligible adverse	Slight adverse	Negligible adverse	Slight adverse
3	Netherhill, Wardrop Road	High	Moderate adverse	Moderate adverse	Minor adverse	Slight adverse
4	The Gatehouse, Wardrop Street	High	Major adverse	Very large adverse	Moderate adverse	Moderate adverse
5	Properties 18- 20, Wardrop Road	High	Major adverse	Very large adverse	Major adverse	Large adverse
6	Geilsland School	Moderate	Moderate adverse	Moderate adverse	Minor adverse	Slight adverse
7	Properties 12 & 14 Barrmill Road	High	Major adverse	Very large adverse	Major adverse	Very large adverse
8	16 Barrmill Road	High	Major adverse	Very large adverse	Major adverse	Very large adverse
9	45 Barrmill Road	High	Major adverse	Very large adverse	Major adverse	Very large adverse
10	2 Spiersland Way	High	Major adverse	Very large	Major adverse	Very large

Visual receptor		Sensitivity	During construction (without mitigation)		Post construction (without mitigation)	
			Magnitude of impact	**Significance of impact**	**Magnitude of impact**	**Significance of impact**
				adverse		adverse
11	Manrahead Farmhouse	High	Moderate adverse	Moderate adverse	Minor adverse	Moderate adverse
12	Group of properties Jamieson Way, Dalry Road, Manuel Avenue, McMillan Crescent, Spiers Avenue and St Andrews Place	High	Major adverse	Large adverse	Moderate adverse	Moderate adverse
13	Properties 5-52 McMillian Crescent	High	Moderate adverse	Moderate adverse	Moderate beneficial	Moderate beneficial
14	Properties 46-57 Grahamfield Place and 46 Balfour Avenue	High	Negligible adverse	Slight adverse	Minor beneficial	Moderate beneficial
15	Properties 814 Glebelands Way	High	Minor adverse	Slight adverse	Minor beneficial	Moderate beneficial
16	Amenity grass area, Glebelands Way	Moderate	Minor adverse	Slight adverse	Minor beneficial	Slight beneficial
17	Properties 27-43 Glebelands Way and 40, 40a, 46 Glebe Road	High	Moderate adverse	Moderate adverse	Minor beneficial	Moderate beneficial

Visual receptor		Sensitivity	During construction (without mitigation)		Post construction (without mitigation)	
			Magnitude of impact	**Significance of impact**	**Magnitude of impact**	**Significance of impact**
18	Properties 42,42a, 44 58 Glebe Road	High	Moderate adverse	Moderate adverse	Moderate beneficial	Moderate beneficial
19	Properties 13 -43 Barrmill Road	High	Major adverse	Large adverse	Moderate adverse	Moderate adverse
20	Properties 10a, 10b,10c & 10d Barrmill Road	High	Major adverse	Large adverse	Moderate beneficial	Moderate beneficial
21	Properties 2 -76 Larch Terrace	High	Moderate adverse	Large adverse	Moderate beneficial	Moderate beneficial
22	Properties 1a, 2a, 3a 4a Rowan Avenue & 45-60 Montgomery Avenue	High	Moderate adverse	Large adverse	Moderate beneficial	Moderate beneficial
23	Children's play park, Larch Terrace	High	Moderate adverse	Moderate adverse	Moderate beneficial	Moderate beneficial
24	Properties 1 -12 Wardrop Terrace, 1-2 Wardrop Street and 32, 34, 36, 55 Head Street	High	Major adverse	Very large adverse	Major adverse	Large adverse
25	Properties 2 –10 Aitken Drive	High	Moderate adverse	Moderate adverse	Minor adverse	Moderate adverse

Visual receptor		Sensitivity	During construction (without mitigation)		Post construction (without mitigation)	
			Magnitude of impact	**Significance of impact**	**Magnitude of impact**	**Significance of impact**
26	Thomson of Beith	Low	Major adverse	Moderate adverse	Minor adverse	Slight adverse
27	Properties 14 -32 and 71 Aitken Avenue	High	Moderate adverse	Moderate adverse	Minor adverse	Slight adverse
28	Properties 11-39 Crummock Gardens and Birchbank, Bigholm Road	High	Major adverse	Very large adverse	Negligible adverse	Slight adverse
29	Road users, A737	Low	Major adverse	Moderate adverse	Minor adverse	Slight adverse
30	Road users, Wardrop Street	Low	Major adverse	Moderate adverse	Negligible adverse	Slight adverse
31	Road users, Geilsland Road	Low	Major adverse	Moderate adverse	Moderate adverse	Slight adverse
32	Road Users, Barrmill Road	Low	Major adverse	Moderate adverse	Negligible adverse	Slight adverse

8.8 Visual mitigation

During construction

8.8.1 The landscape mitigation measures identified in paragraph 8.6.1 and the following additional mitigation will be implemented:

- Where practicable, traffic management will be planned to ensure that traffic lights are out of sight of visual receptors and light spillage into adjacent areas is kept to a minimum
- Efficient traffic management operations will reduce impacts on visual receptors. Traffic diversions, if required, will be planned to minimise impacts on visual receptors. Traffic queues as a result of traffic management will be monitored frequently
- Haul roads will be sited and constructed to avoid visual impacts where practicable
- Local residents will be informed of the work and advised of the construction start date, duration and possible visual impacts. A clear line of contact will be established to ensure that concerns can be addressed.

8.8.2 The mitigation measures will help alleviate impacts on views, however they are unlikely to change the significance of impact. It should be reiterated at this point that construction impacts cannot be assessed precisely due to a lack of construction information which will not be available until a contractor is appointed.

Post construction

8.8.3 The mitigation measures for landscape post construction as listed in paragraph 8.6.2 are also appropriate to mitigate the adverse impacts on visual receptors post construction. The following additional mitigation will be implemented:

- Woodland, hedgerow, shrub and grassland planting will carried out to integrate the scheme into the local landscape and to provide screening for visual receptors. A high percentage of fast growing, evergreen and deciduous species will be used to allow for year round screening opportunities. Receptors 7, 8, 9 and 10 will experience a very large adverse impact significance post construction and will require screening from the scheme. Long distant views of Goat Fell on the Island of Arran will be retained for receptor 10
- Screening, fencing and earth bunds will be installed where the proposed A737 passes receptors 7, 8, 9 and 10

- Landscaping will take place at each of the proposed roundabouts to improve the visual amenity of the scheme and create a sense of place
- New lighting along the proposed road alignments will be designed in accordance with the DMRB, Volume 8, Section 3; Design of Road Lighting for the Strategic Motorway and all Purpose Trunk Road Network (TD34/07) (Ref 8.17). Lighting on the proposed roundabouts will be designed in accordance with DMRB, Volume 6, Section 2; Geometric Design of Roundabouts (TD34/07) (Ref 8.18) Guidance from The Institution of Lighting Professionals will also be followed in relation to the extents of the lighting that should be provided at conflict areas (areas where significant streams of traffic intersect with each other)
- Lighting will be directional and will be kept to a minimum in line with health and safety requirements. Where possible, new lighting will not be sited outside residential receptors where lighting is not currently present
- Strategic mitigation planting will take place to soften the impact of new lighting on visual receptors. Receptors 5, 7, 8, 9, 10, 24 and 25 will experience the largest adverse impact from new lighting and where possible, mitigation planting will take place.

8.8.4 The planned mitigation for visual receptors post construction is illustrated within the Landscape Proposals in Drawing 25000199/100/166.

8.9 Visual residual impacts

Year 1 (Winter)

8.9.1 The residual impact magnitude and impact significance for visual receptors are determined using Tables 8.4 and 8.5 respectively. The results are summarised in Table 8.12; the names and locations of each visual receptor are also shown in this table for reference throughout this section. In year 1 it is anticipated that eight receptors will experience a significant adverse impact; receptors 5, 7 - 10, 19, 24 and 25.

8.9.2 As discussed in paragraph 8.7.3, in year 1 the proposed mitigation planting will be immature and will do little to mitigate the impacts of scheme on visual receptors. New woodland and vegetation will not have grown sufficiently to screen views of the scheme and new road infrastructure (eg new ground surfaces, road signs and fencing) will remain emphasised within the landscape due to a lack of weathering. As a result, the impact significance for the majority of visual receptors in year one after opening will remain the

same as reported post construction; receptors 1, 2, 3, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32.

8.9.3 Five receptors will experience a different impact significance in year one after opening; receptors 4, 5, 11, 12 and 31. Impacts on receptors 4 and 5 will reduce slightly due to the reinstatement of the stone wall along Wardrop Street. Larger specimen planting will take place at the proposed Manrahead Roundabout and as a result, the scheme will be screened slightly for receptors 11 and 12. Impacts on receptor 31 will also reduce in year one after opening as users of Geilsland Road will experience reduced views of traffic along the proposed A737. The new alignment and Barrmill Roundabout will be screened by an embankment where some grass will have established. Larger trees will additionally be planted along the embankment which will reduce the visual impact of the scheme for these road users.

Year 15 (Summer)

8.9.4 As discussed in paragraph 8.7.5, after 15 years of operation, mitigation planting will have established successfully and the scheme will be screened for the majority of visual receptors. Table 8.12 summarises the residual impacts for summer in year 15 after opening and provides the names and locations of visual receptor for reference. Six receptors will experience a significant adverse impact magnitude; receptors 5, 7, 8, 9, 10 and 24.

8.9.5 Receptors 7, 8, 9, 10 and 24 are determined to experience a large adverse impact significance in year 15 despite the successful establishment of screening woodland and vegetation. Mitigation planting will reduce the impact significance from very large in year 1 to large in year 15, however as the receptors lie within close proximity to the scheme, views of the improvements will be inevitable. Receptors 7, 8, 9 and 10 will experience screened views of the proposed A737, Barrmill Roundabout and Barrmill Road and will be particularly impacted by new street lighting at the proposed Barrmill Road. Mitigation planting will soften the new lighting for the receptors however light emanating from the roundabout will be a noticeable feature of their views. Receptors 7 and 9 will be particularly impacted due to their elevated views. Receptor 24 will remain impacted by direct, elevated views of the proposed Head Street Roundabout. As there is little opportunity for mitigation planting at this roundabout, screening of the scheme will be limited and views from the properties closest to the roundabout will remain dominated by vehicles and new street lighting.

8.9.6 Receptor 5 will experience a moderate adverse impact significance in year 15 due to its proximity to the proposed Head Street Roundabout. The roundabout will move the A737

several metres closer to the residential properties on Wardrop Street, which will result in a deterioration of their views looking northwest and south west. Similar to receptor 24, there is little opportunity for mitigation planting at the proposed roundabout and so screening of the scheme will be limited. As a result, the receptor will remain impacted by the presence of new street lighting, causing an obvious deterioration to their views.

8.9.7 Twelve receptors will experience a significant beneficial impact in year 15; receptors 4, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22 and 23.

Table 8.12: Summary of visual residual impacts

Visual receptor		Sensitivity	Residual year 1 (Winter)		Residual year 15 (Summer)	
			Magnitude of impact	**Significance of impact**	**Magnitude of impact**	**Significance of impact**
1	Crummock Farmhouse	High	Negligible adverse	Slight adverse	Negligible adverse	Slight adverse
2	Farmhouse Hill of Beith	High	Negligible adverse	Slight adverse	Negligible adverse	Slight adverse
3	Netherhill, Wardrop Road	High	Minor adverse	Slight adverse	Negligible adverse	Slight adverse
4	The Gatehouse, Wardrop Street	High	Moderate beneficial	Moderate Beneficial	Moderate beneficial	Moderate beneficial
5	Properties 18- 20, Wardrop Road	High	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
6	Geilsland School	Moderate	Minor adverse	Slight adverse	Negligible adverse	Slight adverse
7	Properties 12 & 14 Barrmill Road	High	Major adverse	Very large adverse	Major adverse	Large adverse
8	16 Barrmill Road	High	Major adverse	Very large adverse	Major adverse	Large adverse
9	45 Barrmill Road	High	Major adverse	Very large adverse	Major adverse	Large adverse

Visual receptor		Sensitivity	Residual year 1 (Winter)		Residual year 15 (Summer)	
			Magnitude of impact	**Significance of impact**	**Magnitude of impact**	**Significance of impact**
10	2 Spiersland Way	High	Major adverse	Very large adverse	Major adverse	Large adverse
11	Manrahead Farmhouse	High	Minor adverse	Slight adverse	Negligible adverse	Slight adverse
12	Group of properties Jamieson Way, Dalry Road, Manuel Avenue, McMillan Crescent, Spiers Avenue and St Andrews Place	High	Minor beneficial	Moderate beneficial	Minor beneficial	Moderate beneficial
13	Properties 5-52 McMillian Crescent	High	Moderate beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial
14	Properties 46-57 Grahamfield Place and 46 Balfour Avenue	High	Minor beneficial	Moderate beneficial	Minor beneficial	Moderate beneficial
15	Properties 8-14 Glebelands Way	High	Minor beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial
16	Amenity grass area, Glebelands Way	Moderate	Minor beneficial	Slight beneficial	Minor beneficial	Slight beneficial
17	Properties 27-43 Glebelands	High	Minor beneficial	Moderate	Moderate	Moderate

Visual receptor		Sensitivity	Residual year 1 (Winter)		Residual year 15 (Summer)	
			Magnitude of impact	**Significance of impact**	**Magnitude of impact**	**Significance of impact**
	Way and 40, 40a, 46 Glebe Road			beneficial	beneficial	beneficial
18	Properties 42,42a, 44, 58 Glebe Road	High	Moderate beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial
19	Properties 13 -43 Barrmill Road	High	Moderate adverse	Moderate adverse	Moderate beneficial	Moderate beneficial
20	Properties 10a, 10b,10c & 10d Barrmill Road	High	Moderate beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial
21	Properties 2 -76 Larch Terrace	High	Moderate beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial
22	Properties 1a, 2a, 3a, 4a Rowan Avenue & 46-60 Montgomery Avenue	High	Moderate beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial
23	Children's play park, Larch Terrace	High	Moderate beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial
24	Properties 1 -12 Wardrop Terrace, 1-2 Wardrop Street and 32, 34, 36 and 55 Head Street	High	Major adverse	Large adverse	Major adverse	Large adverse

Visual receptor		Sensitivity	Residual year 1 (Winter)		Residual year 15 (Summer)	
			Magnitude of impact	**Significance of impact**	**Magnitude of impact**	**Significance of impact**
25	Properties 2 –10 Aitken Drive	High	Minor adverse	Moderate adverse	Minor beneficial	Slight beneficial
26	Thomson of Beith	Low	Minor adverse	Slight adverse	Minor adverse	Slight adverse
27	Properties 14-32 & 71 Aitken Avenue	High	Minor adverse	Slight adverse	Minor adverse	Slight adverse
28	Properties 11-39 Crummock Gardens and Birchbank, Bigholm Road	High	Negligible adverse	Slight adverse	Negligible adverse	Slight adverse
29	Road users, A737	Low	Minor adverse	Slight adverse	Negligible beneficial	Slight beneficial
30	Road users, Wardrop Street	Low	Negligible adverse	Slight adverse	Negligible beneficial	Slight beneficial
31	Road users, Geilsland Road	Low	Minor beneficial	Slight beneficial	Moderate beneficial	Slight beneficial
32	Road Users, Barrmill Road	Low	Negligible adverse	Slight adverse	Negligible beneficial	Slight beneficial

8.10 Statutory and planning context

8.10.1 Table 8.13 outlines the legislation, plans and policies relevant to this assessment and if the scheme is considered to achieve the objectives of each.

Table 8.13: Statutory and planning context

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives?(Y/N)
Scottish National Planning Framework (NPF 3)	Sets out strategic development priorities for Scotland to 2030, to support the Government's central purpose of sustainable economic growth. The framework sets out the strategy to ensure new development leads to a healthier environment and to high quality, sustainable places.	The project is a large scale new road development which will alter the local environment. The project will create opportunities for a healthier, more sustainable environment.	Y
Scottish Planning Policy (SPP)	A statement of Scottish Government Policy on land use planning. It provides guidance on how the Government's policies for the conservation and enhancement of Scotland's natural heritage should be reflected in land use planning.	With the absence of mitigation, the scheme has the potential to impact landscape features such as woodland, hedgerow and stone walls; all of which contribute to Scotland's natural heritage.	Y
Scottish Rural Development Programme	Sets out Scotland's strategy for sustainable economic growth in Scotland's rural areas for 2014-2020. A main priority includes protecting and	The scheme will include opportunities for improving the natural environment.	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives?(Y/N)
(SRDP)	improving the natural environment.		
Planning Advice Note (PAN) 60: Planning for Natural Heritage	Provides advice on how development can contribute to the conservation and enhancement of the natural environment. Encourages developers to be positive and creative in addressing both nature and landscape issues.	The project involves land take from agricultural land and the removal of landscape features such as woodland, hedgerow and vegetation. There will be opportunities for the enhancement of the local landscape.	Y
PAN 65: Planning and Open Space	Provides advice on the role of the planning system in protecting and enhancing existing open spaces and providing high quality new spaces.	The project involves the creation of new road infrastructure within existing open agricultural land. There will be opportunities for the creation of new open spaces including; shared cycleway/footway, potential viewing/resting area for walkers and cyclists, areas of bulb planting to create seasonal interest	Y
Transport Scotland Policy: Fitting Landscapes	Policy statement addressing the landscape design and management of our transport corridors. Aims include; ensure high quality design and place; enhance and protect natural heritage; use	The project involves the realignment of a major road and the creation of two large roundabouts through agricultural land. The design will be	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives?(Y/N)
	resources wisely; build in adaptability to change.	required to meet Transport Scotland's Fitting Landscapes. The design objectives of the scheme are listed in paragraph 2.1.3. No specific reference is made to the Fitting Landscapes policy, however it is expected to be considered by the final objective; improve sustainability in design and construction.	
North Ayrshire Local Development Plan	Sets out North Ayrshire's strategy to balance nature conservation with development. Aims include: to support, conserve and promote scarce natural resources and landscape character; to conserve and enhance sites of ecological importance. Policies for the Natural Environment and Open Space include; ENV1 New Development in the Countryside (excluding housing); ENV9 Countryside; ENV12 Development of Open Space.	The project will involve the use of natural resources. There will be opportunities to conserve and enhance sites of ecological importance.	Y

8.11 Conclusion

Landscape

8.11.1 During construction, the local landscape will experience a moderate adverse impact before mitigation due to the visual intrusion of construction activities. The presence of construction compounds, construction vehicles and traffic management are typical construction elements which will temporarily reduce the quality of the landscape.

8.11.2 Post construction prior to mitigation, moderate adverse impacts will remain due to the loss of natural landscape features to the scheme. Woodland, grassland, shrub and hedgerow will be lost to accommodate the proposed improvements, while the natural topography of the land will be changed. Further to this, the proposed road, roundabouts and associated infrastructure will not immediately blend with the existing environment due to a lack of landscaping and mitigation planting.

8.11.3 Moderate adverse impacts will again remain for the local landscape one year after the scheme opens. Mitigation planting will not yet have established and subsequently, will not contribute to the landscape character. New road surfaces, signage and fencing will also remain emphasized in the landscape.

8.11.4 Fifteen years after opening, the scheme will bring a slight adverse impact to the local landscape. Despite the successful establishment of mitigation planting, adverse impacts on landcover and tranquillity will remain. Improvements in the quality of woodland, vegetation, hedgerow and grassland will bring a slight beneficial impact to the scale and appearance of the area. Strategic tree planting as part of the landscape design will enhance a sense of place.

Visual

8.11.5 Twenty eight visual receptors within the ZVI are expected to experience a significant adverse impact during construction of the scheme:

- Crummock Farmhouse (receptor 1)
- Netherhill, Wardrop Street (receptor 3)
- The Gatehouse, Wardrop Street (receptor 4)
- Properties 18-20, Wardrop Street (receptor 5)
- Geilsland School (receptor 6)

- Properties 12 and 14, Barrmill Road (receptor 7)
- 16 Barrmill Road (receptor 8)
- 45 Barrmill Road (receptor 9)
- 2 Spiersland Way (receptor 10)
- Manrahead Farm (receptor 11)
- Group of residential properties Jamieson Way, Dalry Road, Manuel Avenue, McMillan Crescent, Spiers Avenue and St Andrews Place (receptor 12)
- Properties 5-52, McMillan Crescent (receptor 13)
- Properties 27-43, Glebelands Way and 40, 40a, 46, Glebe Road (receptor 17)
- Properties 42, 42a, 44 and 58, Glebe Road (receptor 18)
- Properties 13-43, Barrmill Road (receptor 19)
- Properties 10a, 10b, 10c and 10d, Barrmill Road (receptor 20)
- Properties 2-76, Larch Terrace (receptor 21)
- Properties 1a, 2a, 3a, 4a, Rowan Avenue and 45-60, Montgomery Avenue (receptor 22)
- Children's play park, Larch Terrace (receptor 23)
- Properties 1-12, Wardrop Terrace, 1-2 Wardrop Street and 32, 34, 36 and 55 Head Street (receptor 24)
- Properties 2-10, Aitken Drive (receptor 25)
- Thomson of Beith (receptor 26)
- Properties 14-32 and 71, Aitken Avenue (receptor 27)
- Properties 11-39, Crummock Gardens and Birchbank, Bigholm Road (receptor 28)
- Road users, A737 (receptor 29)
- Road users, Wardrop Street (receptor 30)
- Road users, Geilsland Road (receptor 31)
- Road users, Barrmill Road (receptor 32)

8.11.6 Receptors 4, 5, 7, 8, 9, 10, 24 and 28 will experience very large adverse impacts, while receptors 12, 19, 20, 21 and 22 will experience large adverse impacts. These are the receptors that lie within the immediate proximity of the scheme and will have direct views of the construction work.

8.11.7 Receptors 1, 3, 6, 11, 13, 17, 18, 23, 25, 26, 27, 29, 30, 31 and 32 will experience moderate adverse impacts due to slight screening of the construction work from vegetation and the topography of the land.

8.11.8 Four receptors will not experience a significant adverse impact during construction due to their distance from the scheme and/or extensive screening of the construction work from trees, vegetation and boundary treatments:

- Farmhouse, Hill of Beith (receptor 2)
- Properties 46-57, Grahamfield Place and 46 Balfour Avenue (receptor 14)
- Properties 8-14, Glebelands Way (receptor 15)
- Amenity grass area, Glebelands Way (receptor 16)

8.11.9 Once construction is complete, there will be no significant impacts on the majority of receptors that were affected by the visually intrusive construction works. Significant adverse impacts will however remain for eleven receptors that lie in close proximity to the scheme. Their views will be dominated by the proposed improvements and associated infrastructure before mitigation:

- The Gatehouse, Wardrop Street (receptor 4)
- Properties 18-20, Wardrop Street (receptor 5)
- Properties 12 and 14, Barrmill Road (receptor 7)
- 16 Barrmill Road (receptor 8)
- 45 Barrmill Road (receptor 9)
- 2 Spiersland Way (receptor 10)
- Manrahead Farm (receptor 11)
- Group of properties Jamieson Way, Dalry Road, Manuel Avenue, McMillan Crescent, Spiers Avenue and St Andrews Place (receptor 12)
- Properties 13-43, Barrmill Road (receptor 19)

- Properties 1-12 Wardrop Terrace, 1-2 Wardrop Street and 32, 34, 36, 55 Head Street (receptor 24)
- Properties 2-10, Aitken Avenue (receptor 25)

8.11.10 Receptors 7, 8, 9 and 10 will experience very large adverse impacts as they lie within close proximity to the improvements and will have direct views of the proposed A737 and Barrmill Roundabout.

8.11.11 Receptors 5 and 24 will experience large adverse impacts due to their proximity to the proposed Head Street Roundabout. The views from these receptors will be particularly impacted by new street lighting.

8.11.12 Receptors 4, 11, 12, 19 and 25 will experience moderate adverse impacts after construction as the improvements will lead to a noticeable loss of views from their properties.

8.11.13 In year one after opening, impacts on the majority of visual receptors will remain the same as the post construction phase. Mitigation planting will not have established and will do little to screen the proposed improvements from the receptors. Five receptors will experience a reduced adverse impact after one year of opening:

- The Gatehouse, Wardrop Street (receptor 4)
- Properties 18-20, Wardrop Street (receptor 5)
- Manrahead Farm (receptor 11)
- Group of properties Jamieson Way, Dalry Road, Manuel Avenue, St Andrews Place, Spiers Avenue and McMillan Crescent (receptor 12)
- Road Users, Geilsland Road (receptor 31)

8.11.14 A significant adverse impact will remain for eight receptors in winter of year one:

- Properties 18-20, Wardrop Street (receptor 5)
- Properties 12 and 14, Barrmill Road (receptor 7)
- 16 Barrmill Road (receptor 8)
- 45 Barrmill Road (receptor 9)
- 2 Spiersland Way (receptor 10)
- Properties 13-43, Barrmill Road (receptor 19)

- Properties 1-12 Wardrop Terrace, 1-2 Wardrop Street and 32, 34, 36, 55 Head Street (receptor 24)
- Properties 2-10, Aitken Avenue (receptor 25)

8.11.15 In summer of year 15 after opening, six receptors will experience significant adverse impacts from the scheme, despite the successful establishment of mitigation planting:

- Properties 18-20, Wardrop Street (receptor 5)
- Properties 12 and 14, Barrmill Road (receptor 7)
- 16 Barrmill Road (receptor 8)
- 45 Barrmill Road (receptor 9)
- 2 Spiersland Way (receptor 10)
- Properties 1-12, Wardrop Terrace, 1-2 Wardrop Street and 32, 34, 36 and 55 Head Street (receptor 24)

9 Ecology and Nature Conservation

9.1 Introduction

9.1.1 This chapter considers the likely impacts on ecology and nature conservation arising from the construction and operation of the scheme. Ecology is defined by the Oxford Dictionary (Ref 9.1) as "the branch of biology that deals with the relations of organisms to one another and to their physical surroundings". Nature conservation is defined by the Oxford Dictionary (Ref 9.1) as "the preservation of wild fauna and flora and natural habitats and ecosystems, especially from the effects of human exploitation, industrialisation etc". The key issues relating to ecology and nature conservation arising from the scheme are:

- The potential to cause a barrier effect and severance on terrestrial animals, and increasing traffic related mortalities
- The high potential of habitat loss or disturbance from land-take, noise, run-off and pollution.

9.1.2 The assessment has been carried out using guidance provided for a detailed assessment from the Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 4 "Ecology and Nature Conservation" (Ref 9.2), with supplementary guidance from IAN 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment (Ref 9.3) and The Chartered Institute of Ecology and Environmental Management's (CIEEM) Guidelines for Ecological Impact Assessment in the United Kingdom (Ref 9.4).

9.2 Methodology

Statutory and planning review

9.2.1 A desktop review of current legislation, planning policy and technical guidance was carried out between 17 November 2015 and 7 December 2015 to identify all relevant information to the project in relation to ecology and nature conservation.

9.2.2 The following information sources were reviewed:

- Scottish Planning Policy. Subject Policy – A Natural, Resilient Place, 2014 (Ref 9.5)

- National Planning Framework 3, 2014 (Ref 9.6)
- The 2020 Challenge for Scotland's Biodiversity, 2013 (Ref 9.7)
- Planning Advice Note (PAN) 60 – Planning for Natural Heritage, 2008 (Ref 9.8)
- Joint Nature Conservation Committee, UK Post-2010 Biodiversity Framework, 2012 (Ref 9.9)
- Scotland's Biodiversity: It's in your hands, 2004 (Ref 9.10)
- Ayrshire Joint Planning Steering Group, Ayrshire Local Biodiversity Action Plan (LBAP) 2008 (Ref 9.11)
- North Ayrshire Council, North Ayrshire Local Development Plan, 2014 (Ref 9.12)
- Wildlife and Countryside Act 1981 (Amendment) (Scotland) Regulations 2001 (Ref 9.13)
- Nature Conservation (Scotland) Act 2004 (Ref 9.14)
- Protection of Badgers Act 1992 (Ref 9.15)
- The Habitats Directive (92/43/EEC), 1992 (Ref 9.16)
- The Conservation (Natural Habitats & c.) Amendment (Scotland) Regulations 2012 (Ref 9.17).

Determination of baseline

9.2.3 The baseline conditions relating to ecology and nature conservation were determined through desk based study, field surveys and consultations with relevant parties.

Study area

9.2.4 For the desk study, the study area was taken to be 2km from the scheme in accordance with the DMRB Volume 11, Section 4, Assessment of Implication on European Sites (Ref 9.18), to allow identification and consideration of European designated sites (including Special Areas of Conservation (SACs), candidate or possible SACs (cSACs or pSACs), Special Protection Areas (SPAs), potential SPAs (pSPAs), Wetlands of International Importance (Ramsar sites), and Sites of Community Importance (SCIs). This study area was extended to 30km to consider European sites that are designated for bat species.

9.2.5 The study area for the field surveys was determined by the phase 1 habitat survey carried out during 2014 for the Stage 2 EIA which identified the habitats within the area and determined the species surveys required. The corridor of land surveyed extended east from the existing A737. The area to the west was not considered due to the presence of the town of Beith.

9.2.6 The survey area extends eastwards up to 450m from the existing A737 to include areas that might be needed for construction or accommodation works. The survey area also extended into habitats of particular interest or where it was considered that evidence of protected species might be found based on habitat availability.

Desk study

9.2.7 A desk study was undertaken to identify notable or protected sites, habitats, or species potentially affected by the scheme. The following resources were used and were accessed between 17 November 2015 and 7 December 2015:

- The Multi-Agency Geographic Information for the Countryside (MAGIC) website (Ref 9.19)
- Scottish Natural Heritage (SNH), Advice for Planners and Developers (Ref 9.20)
- Scottish Environment Protection Agency (SEPA) Website (Ref 9.21)
- Ayrshire Joint Planning Steering Group, Ayrshire Local Biodiversity Action Plan (LBAP) (Ref 9.11)

9.2.8 Amey produced a Stage 2 EIA and the information gathered from the field surveys undertaken in 2014 was used to inform this Environmental Statement, specifically:

- Phase 1 Habitat Survey Report
- Bat Survey Report
- Badger Report
- Breeding Bird Survey Report
- Wintering Bird Survey Report (carried out by RSK)
- Otter and Water Vole Survey Report
- Great Crested Newt – Habitat Suitability Index (contained within the Phase 1 Habitat Survey Report)

Field surveys

9.2.9 A number of surveys were carried out during the Stage 2 EIA (listed within Section 9.2.8), which were repeated where necessary to account for developments in the design between Stages 2 and 3 and during Stage 3. This included:

- Badger survey
- Bat survey
- Breeding bird survey
- Wintering bird survey
- Water vole survey

9.2.10 The Stage 3 ecological surveys were undertaken between 12 March 2015 and 14 January 2016 to assess the baseline flora and fauna within the study area. The survey reports are contained within Appendices 9.1–9.8 of the Environmental Statement. These repeated surveys targeted areas likely to be affected by the scheme, and also considered any changes in the baseline.

9.2.11 The phase 1 habitat survey (Appendix 9.1) and great crested newt *Triturus cristatus* Habitat Suitability Index (HSI) were not repeated as the conditions and habitats present within the study area had not changed in the intervening year between Stage 2 and Stage 3. The otter *Lutra lutra* survey was not repeated following the 2014 survey as Powgree Burn will not be affected by the scheme.

Phase 1 habitat survey

9.2.12 Habitats present in the study area were surveyed by experienced ecologists. The survey was carried out on 27 May 2014 and was conducted in accordance with the Joint Nature Conservation Committee's (JNCC) Handbook for Phase 1 Habitat Survey – technique for environmental audit (1993) (revised print in 2010) (Ref 9.31). The survey was carried out using a "go-book", global positioning system (GPS) and Arc Pad geographical information system (GIS) software to electronically record habitats.

9.2.13 As stated in paragraph 9.2.11 the survey was not repeated during 2015 as it was considered that the conditions and habitats had not changed in the intervening year.

Badger survey

9.2.14 Badger *Meles meles* surveys were carried out on 30 April and 1 May 2014 to support the Stage 2 EIA by experienced ecologists in accordance with guidance from SNH's "Scotland's Wildlife: Badgers and Development" (Ref 9.22). The survey area extended east up to 450m from the existing A737. This area was systematically surveyed for field signs, such as pathways, dung pits and latrines, guard hairs, snuffle holes, setts. Any field signs were recorded electronically using a "go-book", GPS and Arc Pad GIS software. The surveys were repeated on 12 March 2015 and 14 April 2015 to support the Environmental Statement (Appendix 9.2).

Bat survey

9.2.15 During the Stage 2 EIA, bat activity surveys were carried out along walked transects on 25 June 2014 and 7 August 2014 by experienced ecologists. The methodology adopted for the activity survey and report is set out in the Bat Conservation Trust "Bat Surveys: Good Practice Guidelines" (Ref 9.23) and the Joint Nature Conservation Committees "Bat Workers Manual, 3rd edition" (Ref 9.24). All bat passes were recorded electronically using a "go-book", GPS and Arc Pad GIS software, and detected using BatBox Duets. As part of the Environmental Statement these surveys were repeated on 7 May 2015, 8 May 2015, 16 June 2015 and 17 June 2015. The transects were undertaken by experienced ecologists and are shown on Figure 1, within the Bat Survey Report (Appendix 9.3). The location of the transects were determined using features of the landscape likely to be used by bats such as tree lines and hedgerows which are identified in the phase 1 habitat drawing (Figure 9.1). The bat surveys carried out entailed stopping at seven listening points along the transects (detailed in Appendix 9.3, Figure 1) with 10 minutes allotted for each point for bat detection.

9.2.16 A change in the design during Stage 3 meant that the area for bat surveys was extended to include land to the south of Spier's Old School Ground. The phase 1 habitat survey included this area and identified several mature trees in the area which could have potential bat roosts. This area was subject to a detailed walkover to assess the trees in the area for bat roost potential on the 22 December 2015 following guidelines set out in the Bat Conservation Trust "Bat Surveys: Good Practice Guidelines" (Ref 9.23). Each tree was systematically searched for features that may

be used by bats including; natural holes, woodpecker holes, cracks/splits in major limbs, loose bark and hollow cavities.

Breeding bird survey

9.2.17 A breeding bird survey was conducted as part of the Stage 2 EIA with surveys carried by experienced ecologists on 26 June 2014 and 22 July 2014. The surveys consisted of a walked transect survey which recorded visual observations and song recognition to identify bird species present in the survey area. The survey aimed to identify areas within the study area which may be utilised for breeding birds and to identify species that are rare or threatened. Surveys were undertaken using a methodology adapted from the British Trust for Ornithology (BTO) Breeding Bird Survey Methodology (Ref 9.25). The timings of these surveys were slightly late in the season and outwith the recommended timings in the above guidance, this was to account for a late spring. A transect through the survey area was walked, which is shown in Drawings 25000199-WP10-900-001 and 25000199-WP10-900-002, within the Breeding Bird Survey Report in Appendix 9.4. All identified species (identified by sight and song) were recorded electronically using a "go-book", GPS and Arc Pad GIS software.

9.2.18 The surveys were repeated on 8 May 2015, 9 June 2015 and 21 July 2015. The first two dates are within the bird breeding season which runs from March to August (inclusive), and the optimum times in accordance with BTO methodology which states April to mid-May as the ideal time for the first survey, and the second survey four weeks later, between mid-May and the end of June. The third survey was undertaken within the bird breeding season but outwith the optimum time period and was done to reflect a change in design. The details of the survey are shown in within Appendix 9.5, Figure 1.

Wintering bird survey

9.2.19 The Stage 2 EIA wintering bird survey was not repeated in its entirety for the ES as the previous survey (carried out by RSK – Appendix 9.6)) remained applicable. The RSK survey was carried out on 17 February and 28 February 2014, in accordance with Gilbert et al, Bird Monitoring Methods (Ref 9.26). However, due to a change in design a small area to the south of Spier's Old School Ground was surveyed for non-breeding bird assemblages, as the previous wintering bird survey did not incorporate this area. This area was therefore subject to surveys, carried out on

22 December 2015 and 14 January 2016 by experienced ecologists. The survey was carried out in accordance with Gilbert et al, Bird Monitoring Methods (Ref 9.26) and included walk-overs during daylight hours and a vantage point survey from within the area to record activity around the edge of the woodland.

Water vole survey

9.2.20 A water vole *Arvicola amphibius* survey was carried out on 14 April 2015 by experienced ecologists. The survey was conducted in accordance with Strachan et al, Water Vole Conservation Handbook, 3rd Edition (Ref 9.27). An assessment of the ditches and small burn within the survey area was undertaken and the results were recorded electronically using a "go-book", GPS and Arc Pad GIS software. Field signs were recorded including faeces, latrines, burrows, runs, feeding stations, footprints along with any sightings. The details of the survey are shown in within Appendix 9.8.

Consultation

Consultation for Stage 2 EIA

9.2.21 Consultation was carried out with Scottish Natural Heritage (SNH) as part of the Stage 2 EIA. Their response did not identify specific natural heritage interests, and referred to protected species guidance.

9.2.22 Consultation was carried out with Scottish Badgers as part of the Stage 2 EIA, and their response did not identify any badger fatalities on the A737 in the study area, but confirmed there are records in the wider area. They recommended surveys to confirm the presence of badger, and suggested mitigation should badgers be found in the immediate area.

9.2.23 Consultation was carried out with Bat Conservation Trust (BCT) as part of the Stage 2 EIA, and they referred to online sources of information and guidance.

9.2.24 Consultation was carried out with the Amphibian and Reptile Conservation Trust to supplement information for the Phase 1 Habitat Survey Report regarding local records of great crested newts (GCN) in the area, however their records indicated no presence of GCNs in the area.

9.2.25 Consultation was also carried out with North Ayrshire Council - Ranger Service, Scottish Ornithology Society, and the Royal Society for the Protection of Birds (RSPB). No response was received from these organisations.

Consultation for Environmental Statement

9.2.26 Full details of the consultations carried out for inclusion in the Environmental Statement can be found in Chapter 5 Consultation, Table 5:1.

9.2.27 Further consultation was carried out with Scottish Badgers who stated there were no new badger records received in the area, but requested that surveys are updated prior to works given the time lapse and precautions should be taken by the workforce should a badger sett be encountered.

9.2.28 Further consultation was carried out with SNH and their response was the same as the Stage 2 EIA confirming that there are no known natural heritage interests in the study area.

9.2.29 Further consultation was carried out with North Ayrshire Council - Ranger service, the British Trust for Ornithology, the RSPB, and the Scottish Wildlife Trust. No response was received from these organisations

Criteria for assessing impact on ecology and nature conservation

9.2.30 This assessment was carried out in accordance with the DMRB, Volume 11, Section 3, Part 4, Ecology and Nature Conservation (Ref 9.2), with additional Interim Advice Note (IAN) 130/10 (used for supplementary guidance). The Chartered Institute of Ecology and Environmental Management's (CIEEM) Guidelines for Ecological Impact Assessment in the United Kingdom (Ref 9.4) was also used for additional guidance on assessing the ecological impacts of the scheme.

Assessing value

9.2.31 The ecological assessment focusses on the conservation value of ecological receptors. Table 9.1 illustrates the approach taken to value a nature conservation receptor considering both the importance of the habitat type and the characteristics of the species, including rarity and population size.

Table 9.1: Nature conservation receptor valuation

Value	Habitat characteristics	Species characteristics
International importance	An internationally designated site or candidate site: Special Protection Areas (SPA); Potential SPAs (pSPA); Special Areas of Conservation (SAC); candidate or possible SAC (cSAC or pSAC) and Wetlands of International Importance (Ramsar sites).	A large viable population of internationally protected species, especially migratory species, which are rare within an international context.
National importance	A nationally designated site including: Sites of Special Scientific Interest (SSSI); Areas which meet the published selection criteria eg JNCC (1998) for those sites listed above but which are not themselves designated as such. Significant areas of key/priority habitats identified in the UK Biodiversity Action Plan (BAP) (now superseded – see Table 9:11), and those considered to be of principal importance for the conservation of biodiversity.	A large and viable population of internationally protected species which are regularly occurring but scarce within an international context. Rare in a national context.
Regional importance	Areas of key/priority habitat identified as being of Regional value in the appropriate Natural Area Profile (or equivalent); areas that have been identified by regional plans or strategies as areas for restoration or re-creation of priority habitats.	A large and viable population of nationally rare or protected species. Significant populations of Scottish Biodiversity List (SBL) priority species and legally protected species. Rare within a regional context.

Value	Habitat characteristics	Species characteristics
Council importance	Designated sites including: Sites of Nature Conservation Importance (SNCIs); and Local Nature Reserves (LNRs) designated in the local authority area context. Areas of key/priority habitats identified in the Local BAP; and areas of habitat identified in the appropriate Natural Area Profile (or equivalent).	Significant populations of local BAP species and legally protected species and legally protected species. Notable assemblage of key biodiversity species.
Local importance	Sites of local importance, areas of habitat; or populations/communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features.	Population/communities of species considered to appreciably enrich the habitat resource within the local context including features of value for migration, dispersal or genetic exchange. Few individuals of a regularly occurring species of a local interest or biodiversity interest.
Within the zone of influence	Habitats that may be of value within the context of the site and immediate surroundings.	Other species which may be of interest.

Characterisation of ecological impacts

9.2.32 Assessing impacts on ecological receptors involves understanding the impacts likely to arise during both construction and operation of the scheme along with the more permanent impacts of the scheme, including the scheme footprint and land take required. Professional judgement is used to identify the potential impacts on ecological receptors and ecological connectivity.

9.2.33 The scheme could affect ecological receptors in the following ways:

- Land-take
- Severance
- Direct species mortality
- Changes to hydrology
- Water pollution
- Impacts of lighting
- Air pollution
- Noise/ disturbance
- Invasive species transfer.

9.2.34 When assessing the impacts on ecological receptors it is necessary to consider the following parameters:

- Likelihood of impact (certain, probable, unlikely)
- Positive or negative impact
- Scale of impact ie the degree of change
- Duration of impact (permanent/ temporary)
- Reversibility
- Timing and frequency

Significance of Impact

9.2.35 The significance of impact was assessed in accordance with IAN 130/10. Using the valuation of conservation receptors and the characterisation of ecological impacts, Table 9.2 identifies significance category for each ecological receptors.

Table 9.2: Significance of effects

Significance category	Descriptors of effects
Very large	An impact on one or more receptor(s) of international, European, UK or National Value
Large	An impact on one or more receptor(s) of Regional value
Moderate	An impact on one or more receptor(s) of county or unitary authority area value
Slight	An impact on one or more receptor(s) of local value
Neutral	No significant impact on key nature conservation receptors

9.3 Baseline conditions

Desk study

Designated sites

9.3.1 There are no SACs, cSACs, pSACs, SPAs, pSPAs, Ramsar sites, or SCIs within the 2km study area, therefore no further assessment is required.

9.3.2 There are no SACs, cSACs, pSACs or SCIs designated for bat species within 30km of the scheme, therefore no further assessment is required.

Habitats

Local Biodiversity Action Plan

9.3.3 The Ayrshire LBAP was reviewed to identify if any habitats present in the vicinity of the scheme (as identified in the phase 1 habitat survey) have Habitat Action Plans (HAPs). The LBAP habitats present within the study area are detailed in Table 9:3 along with their stated objectives in the HAPs, and any key sites (a specific site or area of importance for the habitat, such as the River Ayr which is a key site for rivers and streams) which are within the study area.

Table 9.3: LBAP habitats identified within the survey area

Habitat	Relevant LBAP objectives	Any key sites? (Y/N)	Location of priority habitat within study area
Rivers and streams	• To maintain and enhance the quality and extent of biodiversity of rivers and streams in Ayrshire • Seek to protect and improve water quality in Ayrshire.	N	A small burn (unclassified) is located along the western edge of Spier's Old School Ground which flows to the south. This burn is described in Chapter 15 Road Drainage and the Water Environment as a field drain. This burn is not considered to be a high quality habitat in the context of the LBAP criteria.
Marshland	• To maintain and enhance the ecological quality of fen, carr marsh swamp and reed bed habitat in Ayrshire • To restore and enhance degraded habitat through appropriate management	N	There are two areas classified as marshy grassland within the study area: • An area west of Geilsland School. • A larger area in the northern extent of the survey area. These areas have been noted below to contain the key species (curlew, snipe, swallow and read bunting - although not in high numbers) to be considered a priority habitat
Standing open water	• To maintain and enhance the ecological quality of standing waters in Ayrshire.	N	There is a small area of the disused railway line that has been classified as standing water. Although the habitat is not considered to be of high quality given the description of this habitat within the LBAP.

Habitat	Relevant LBAP objectives	Any key sites? (Y/N)	Location of priority habitat within study area
Unimproved neutral grassland	• Maintain and enhance areas of unimproved neutral grassland in Ayrshire	N	There is a small area of unimproved grassland in the northern extent of the survey area directly adjacent to the existing A737.
Coniferous woodland	• Maintain and enhance the habitat diversity of coniferous woodland in Ayrshire • Increase the tree species diversity of coniferous woodlands	N	There is a small area of coniferous woodland within Geilsland School grounds. However, the area is too small to be considered a high quality habitat, as it consists of a small group of trees within a school ground.
Parkland and policy woodland	• Maintain and enhance the quality of the habitat within Ayrshire • Identify the extent and distribution of parkland and policy woodland in Ayrshire.	N	There are two areas classified as parkland: Geilsland school grounds. An area of Spier's Old School Ground surrounded by mixed woodland. Spiers Old School Ground can be considered a priority habitat as it contains some of the key species identified in the LBAP as a criterion for classification.

Species

Local Biodiversity Action Plan

9.3.4 The LBAP identifies priority species which have Species Action Plans (SAPs) associated with them. These species are detailed in Table 9:4, with their stated main

objective and associated priority habitats (ie HAPs) that are present within the study area.

Table 9.4: Species identified within the Ayrshire LBAP

Species	**Main objective**	**Associated priority habitat within study area**	**Likely to be present in habitat**
Black grouse *Tetrao tetrix*	To maintain and enhance the population and distribution of black grouse in Ayrshire	Coniferous woodland, marshland	No - BTO describe black grouse habitat as forest which is larger and denser than woodland. Therefore no appropriate habitat for black grouse within the study area
Brown hare *Lepus europaeus*	To maintain and enhance the population and distribution of the brown hare in Ayrshire	Grassland, farmland	Yes – suitable habitat and sighting during Phase 1 habitat survey
Corncrake *Crex crex*	Increase availability of habitat suitable for corncrake re-establishment	Farmland	No – Although one arable field was identified within the study area there is a lack of ecological connectivity with other suitable habitat
Hen harrier *Circus cyaneus*	Maintain and enhance the population and distribution of hen harrier in Ayrshire	Planted coniferous woodland, marshland	No - Not enough suitable hunting habitat to support a hen harrier
Lesser whitethroat	Maintain and enhance the current	Native woodland	Yes – suitable hedgerow and scrub habitat

Species	**Main objective**	**Associated priority habitat within study area**	**Likely to be present in habitat**
Sylvia curruca	population and distribution of the lesser whitethroat in Ayrshire		
Pink meadowcap *Hygrocybe calyptraeformis*	Identify likely locations for the presence of the fungus and survey these locations annually	Unimproved neutral grassland	No – prefers old undisturbed meadows and woodland. The areas in Beith area highly disturbed and therefore not suitable
Pipistrelle bat *Pipistrellus pipistrellus*	Maintain or enhance existing populations and ranges of pipistrelles	Native woodland, parkland and policy woods, coniferous woods, farmland	Yes – several observed throughout bat surveys, detailed below
Song thrush *Turdus philomelos*	Maintain and enhance the current population and distribution of the song thrush in Ayrshire	Farmland, woodland	Yes – Suitable habitat with scrub and woodland providing ideal foraging habitat
Water vole *Arvicola terrestris*	Restore water voles to their former (1970) distribution in Ayrshire	Farmland and wetland habitats	Yes – Network of drainage ditches in north of habitat highlighted for potential habitat during phase 1 habitat survey

Field survey

Habitats

Phase 1 habitat survey

9.3.5 The phase 1 habitat survey aimed to:

- Identify and map habitat types within the survey area
- Evaluate the nature conservation importance of the noted habitats and the survey area as a whole
- Record any field signs of protected species and make recommendations for future surveys.

9.3.6 Table 9.5 lists the habitats recorded within the survey area. These are shown in Figure 9.1 and described in more detail within the Phase 1 Habitat Survey Report (Appendix 9.1).

Table 9.5: Habitats identified from the phase 1 habitat survey, associated code and assinged relative abundance on the DAFOR scale

Amenity grassland (J1.2) (A)	Improved grassland (B4) (A)
Arable land (J1.1) (A)	Marshy grassland (B5) (F)
Bare ground (J4) (O)	Mixed plantation woodland (A1.3.2) (O)
Broadleaved scattered trees (A1.1.1)(O)	Parkland and scattered trees (A3.3) (O)
Buildings (J3.6) (F)	Scrub (A2.2) (O)
Coniferous plantation woodland (A1.2.2) (O)	Semi-natural woodland (A1.2.2)(O)
Dense scrub (A2.1) (O)	Species-poor hedge (J2.1.2/J2.2.2) (F)
Semi-improved grassland (B2.2) (D)	Species-rich hedge (J2.3.1) (O)
Tall ruderal (C3.1) (O)	Standing water (G1) (O)
Unimproved grassland (B2.1) (O)	Running water (G2) (O)

9.3.7 There were 16 Target Notes (TNs) recorded during the survey. These TNs are detailed within Table 9:6, and should be read in conjunction with Figure 9.1.

Table 9.6: Target notes described in the Phase 1 Habitat Survey Report

Target note	Feature
1	Brown hare *Lepus europaeus* sighting
2	Tree line with bat potential
3	Gorse outcrop
4	Mature tree line with bat potential
5	Disused building with bat potential
6	Japanese knotweed
7	Specimen beech tree
8	Mammal pathway
9	Mature beech tree avenue
10	Disused railway line
11	Old Railway Bridge with bat roost potential
12	Mature broadleaf tree line
13	Mature beech tree
14	Six standard ash trees
15	Line of mature sycamores
16	Mammal hole

9.3.8 An updated phase 1 habitat survey was not carried out during the preparation of the ES as the Phase 1 Habitat Survey Report was considered to remain applicable as there were no changes in the intervening year, which was confirmed by the badger survey carried out in March 2015.

Assigning a value to habitats

9.3.9 Not all of the identified habitats will be impacted by the scheme. Any habitats outwith the footprint of the scheme where there is no ecological connectivity between the habitat and the scheme are scoped out of the assessment and not considered further. This applies to coniferous woodland, parkland and policy woodland, broadleaved scattered trees, buildings, dense scrub, tall ruderal, improved grassland, mixed plantation woodland, and scrub.

9.3.10 The nature conservation value of habitats within the scheme footprint, or with an ecological connectivity to the scheme, which may be considered as priority habitats in

the Ayrshire LBAP (Table 9:3) are considered individually based on the value of the habitat within the context of the site. The areas of marshy grassland are considered to be of local importance due to the identification of key species (curlew and snipe) within the surveys carried out below (specifically wintering bird survey and breeding bird survey). All other affected habitats are considered to be valued within the context of the site due to the low quality of the habitats as described in Table 9:1 (the assigned values are summarised in Table 9:9).

Protected species

Badger

9.3.11 The survey systematically checked an area up to 500m east of the existing A737 (detailed in Chapter 2 The Project and Alternatives Considered). Although there were no definitive badger field signs identified, there were a number of mammal pathways throughout the area in various fields and in the disused railway line, shown in Photograph 9:1 and 9:2. No records of badger in the study area were received from The Scottish Badgers.

Photograph 9:1: Mammal pathway in the north of the survey area

Photograph 9:2: Mammal pathway in the disused railway line

9.3.12 Consultation with Scottish Badgers recommended identification of setts as early as possible to mitigate appropriately and create a badger protection plan. The repeated survey did not record any definitive field signs within the survey area. Therefore it is considered that badgers are not an ecological receptor that will be affected by the scheme and are not assessed further.

Bats

9.3.13 The transect surveys carried out in 2014 aimed to assess the activity levels and diversity of bat species in the survey area which was assessed as medium quality for bats. The surveys identified several common pipistrelles *Pipistrellus pipistrellus* and soprano pipistrelles *Pipistrellus pygmaeus*, and potential *Myotis* spp. The surveys identified flightpaths along the edge of Spier's Old School Ground (Photograph 9:3), a mature tree line in the north of the survey area and along the disused railway line.

Photograph 9:3: Treeline at the edge of Spiers Old School Ground

9.3.14 The transect surveys were repeated in 2015 by experienced ecologists to support the Environmental Statement and additional areas were included to reflect scheme design changes, this included additional listening points on Geilsland Road and the B706, South of Spier's Old School Ground. The surveys identified an additional foraging corridor along the existing Geilsland Road but no additional species were present compared to the 2014 surveys. The Bat Survey Report is contained within Appendix 9.3 of the survey report. Figure 1 of the appendix details the location of the listening points.

9.3.15 The phase 1 habitat survey identified features with bat roost potential which included two tree lines with bat potential in the northern extent of the survey area (TN 2, 4), a disused building on Wardrop Street (TN 8) and the old railway bridge (TN 12).

9.3.16 As part of the repeated bat surveys (Appendix 9.3) an additional bat roost potential survey was carried out in an area of mature trees south of Spier's Old School Ground to reflect a change in scheme design. Approximately 17 trees were assessed. Only one dead tree was found to have high bat roost potential. The tree is located at National Grid Reference (NGR) NS 35242 53098 (Figure 1, within Appendix 9.3 shows the exact location) and is classified as a category 1 tree in accordance with the Table 8.4 of the Bat Conservation Trust "Bat Surveys: Good Practice Guidelines" (Ref 9.23) due to "definite bat potential, supporting fewer suitable features that category 1*

trees or with potential for use by a single bats". Photographs 9:4 and 9:5 detail the features that determined the classification as a category 1 tree. The remaining trees in the area are classified as category 3 trees as they have no features that would support a bat roost.

Photograph 9:4: Category 1 tree located south of Spier's Old School Ground

Photograph 9:5: Cracks and holes in tree south of Spier's Old School Ground with bat roost potential

9.3.17 All bat species found in Scotland are European protected species and are fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Furthermore, common pipistrelles were identified in the surveys which are identified within the SBL and the LBAP (and have a SAP associated with them). Considering this and the use of the area by bat species and the high potential for a bat roost in a tree south of Spier's Old School Ground, the nature conservation value for bat species is of local importance (see Table 9:9). This is due to the lack of features that could be considered imperative to the population of bats such as maternity roots, in accordance with Table 9:1 which defines the criteria of a nature resource value. The Bat Survey Report is included within Appendix 9.3.

Breeding birds

9.3.18 A breeding bird survey was conducted as part of the Stage 2 EIA with surveys carried out by experienced ecologists on 26 June 2014 and 22 July 2014. The surveys consisted of a transect survey which recorded visual observation and song recognition to identify bird species present in the survey area. The survey aimed to

identify areas within the study area which may be utilised for breeding birds and to identify species that are rare or threatened.

9.3.19 A number of suitable breeding habitats were identified during the phase 1 habitat survey including; broadleaved scattered trees, coniferous plantation woodland, mixed plantation woodland, parkland and scattered trees, semi-natural woodland and species-rich hedgerow. These habitats provide potential nesting and foraging habitat for a variety of species throughout the study area. The breeding bird survey aimed to identify the species using the area and identify the corresponding Birds of Conservation Concern (BoCC) classification. The survey identified 12 species of Green status, seven of Amber status and two of Red status. None of the species are protected under the Wildlife and Countryside Act 1981 (Amendment) (Scotland) Regulations 2001 or the Wildlife and Natural Environment (Scotland) Act 2011 as a Schedule 1 species.

9.3.20 The breeding bird survey was repeated in 2015 to support the preparation of the Environmental Statement, and included areas not previously surveyed in 2014 to reflect a change in scheme design. The repeated survey identified 13 species of Green BoCC status, 3 Amber BoCC status and 3 red BoCC status. All species identified in both surveys are listed in Table 9:7.

Table 9.7: Bird species identified during the breeding bird surveys

Species	**BoCC classification**
Black bird *Turdus merula*	Green
Blue tit *Cyanistes caeruleus*	Green
Carrion crow *Corvus corone*	Green
Chaffinch *Fringilla coelebs*	Green
Coal tit *Periparus ater*	Green
Common gull *Larus canus*	Amber
Dunnock *Prunella modularis*	Amber
Feral pigeon *Columbia livia*	Green
Great tit *Parus major*	Green
House martin *Delichon urbica*	Amber
House sparrow *Passer domesticus*	Red
Jackdaw *Corvus monedula*	Green
Lesser black-backed gull *Larus fascus*	Amber

Species	BoCC classification
Long tailed tit *Aegithalos caudatus*	Green
Magpie *Pica pica*	Green
Reed bunting *Emberiza schoeniclus*	Amber
Robin *Erithacus rebucula*	Green
Rook *Corvus fruilegus*	Green
Starling *Sturnus vulgaris*	Red
Swallow *Hirundo rustica*	Amber
Swift *Apus apus*	Amber
Stock dove *Columba oenas*	Amber
Tree sparrow *Passer montanus*	Red
Willow warbler *Phylloscopus trochilus*	Amber
Wood pigeon *Columba palumbus*	Green
Wren *Troglodytes troglodytes*	Green

9.3.21 The results of the Breeding Bird Surveys indicate that the site is of importance to a variety of species; however none are a Schedule 1 species or Annex 1 species under the Wildlife and Countryside Act 1981 (Amendment) (Scotland) Regulations 2011 and the Birds Directive. The habitats highlighted as important for breeding birds for nesting, foraging and predator evasion in the Breeding Bird Report (Appendix 9.5) include woodland (Spier's Old School Ground) and hedgerows. In accordance with Table 9:1, which defines the criteria for nature conservation values, breeding birds are considered to be of local importance as the site is not regionally or nationally important for the survival of any of the identified bird species.

9.3.22 There were some minor limitations noted during these surveys, including restrictions on assessing nocturnal species (predominantly owl), weather, possible implications of Personal Protective Equipment (PPE) and surveys being undertaken outwith the optimum dates recommended by the BTO.

Wintering birds

9.3.23 RSK were commissioned by Amey to undertake a wintering bird survey for inclusion in the Stage 2 EIA. Transect surveys were carried out in line with professional

guidance from Gilbert et al , Bird Monitoring Methods (Ref 9.26) on 17 February 2014 and 28 February 2014 by RSK ecologists.

9.3.24 The survey identified 32 species of bird, including 19 of Green BoCC status, seven Amber BoCC status, and six Red BoCC status, as detailed in Table 9:8. The survey found areas of land that may be of considerable value for foraging and predator avoidance including hedgerow, tree lines and woodland.

Table 9.8: Non-breeding birds identified during the survey

Species	**BoCC classification**
Mallard *Anus platyrhynchos**	Amber
Common gull *Larus canus*	Amber
Lesser black-backed gull *Larus fuscus*	Amber
Common buzzard *Buteo buteo*	Green
Snipe *Gallinago gallinago*	Amber
Woodcock *Scolopax rusticola*	Amber
Feral pigeon *Columbia livia*	Green
Wood pigeon *Columba palumbus*	Green
Greater spotted woodpecker *Dendrocopos major*	Green
Wren *Troglodytes troglodytes*	Green
Dunnock *Prunella modularis*	Amber
Robin *Erithacus rubecula*	Green
Fieldfare *Turdus pilaris*	Red
Mistle thrush *Turdus viscivorus*	Amber
Song thrush *Turdus philomelos*	Red
Blackbird *Turdus merula*	Green
Blue tit *Cyanistes caeruleus*	Green
Coal tit *Periparus ater*	Green
Great tit *Parus major*	Green
Treecreeper *Carthia familiaris*	Green
Carrion crow *Corvus corone*	Green
Jackdaw *Corvus monedula*	Green
Raven *Corvus corax*	Green

Species	BoCC classification
Rook *Corvus frugilegus*	Green
Magpie *Pica pica*	Green
Starling *Sturnus vulgaris*	Red
House sparrow *Passer domesticus*	Red
Chaffinch *Fringilla coelebs*	Green
Common linnet *Carduelis cannabina*	Red
Goldfinch *Carduelis carduelis*	Green
Grey heron *Ardea cinerea*	Green
Redwing *Turdus iliacus*	Red

9.3.25 The survey found six species on the Scottish Biodiversity List (SBL), including woodcock, dunnock, redwing, song thrush, starling and common linnet, and two Schedule 1 species; fieldfare and redwing.

9.3.26 The survey identified three areas as "noteworthy non-breeding bird habitat" for snipe, grey heron and woodcock, the first area covers the northern extent of the survey area, a predominantly marshy grassland habitat. The second area is central which includes a marshy grassland habitat and the western edge of Spier's Old School Ground, and finally the third area is east of Manrahead roundabout and consists of semi-improved grassland. These areas are shown in Appendix 9.6, Figure 1 in the Wintering Bird Survey Report.

9.3.27 The survey was not repeated for the ES as it was considered that the previous survey was still applicable. However a small additional area was surveyed in 2015 to reflect a change in scheme design. No additional species were identified to those listed in Table 9:8.

9.3.28 Considering the data collected within the previous survey report for the Stage 2 EIA, specifically the identification of Schedule 1 species, the nature conservation value of the area is considered to be within the zone of influence as the species identified are relatively common woodland and farmland species and none are considered to be internationally important migratory species.

Otter

9.3.29 An otter survey was carried out by experienced ecologists on 8 October 2014 to identify any field signs that would indicate the presence of otter in Powgree Burn.

9.3.30 During consultation, Ayrshire Rivers Trust noted that Powgree Burn provides suitable habitat for otter due to the foraging potential of salmon *Salmo salar*, trout *Salmo trutta*, eels and sticklebacks, and additionally Powgree has suitable resting areas for otter. Old otter spraint was identified during the survey at Powgree Burn (Photograph 9:6), however there were no other field signs found and it was concluded that the burn may form part of a home range, but that otter did not inhabit the immediate area (Appendix 9.7).

Photograph 9:6: Old otter spraint identified in Powgree Burn

9.3.31 This survey was not repeated in 2015 due to Powgree Burn being outside the survey area and the final design not affecting the burn (approximately 230m at the closest point). All other watercourses within the study area are of no interest to otter because they are considered to be too small and offer no value in terms of prey species etc. Therefore otter are scoped out of any further assessment.

Water vole

9.3.32 The phase 1 habitat survey identified a network of ditches at the northern extent of the study area, these are shown in Figure 9.1 within the Phase 1 Habitat Survey Report (located in Appendix 9.1) and in Photograph 9:7.

Photograph 9:7: Network of ditches with abundant vegetation

9.3.33 The habitat was assessed as being of medium quality habitat for water vole (determined during the survey carried out in 2014) due to the predominantly steep banks and surrounding vegetation, including compact rush *Juncus conglomeratus*, soft grass *Holcus sp.*, meadow grass *Poa annua*, bent grass *Agrostis sp*. and some thistle species. It is not considered high quality due to the narrow width and shallow/no water in the ditches. The network of ditches in the north of the survey area was considered medium habitat for water voles due to the steep banks and dense vegetation (Photograph 9:8).

9.3.34 It was determined that the field signs identified during the survey, which included sighting, pathways, holes and droppings, were very likely to belong to the common field vole *Microtus agrestis*. This was due to the size and colour of the droppings found, and the individuals seen were too small to be water vole.

Photograph 9:8: Ditch located in northern area of the study area surveyed for water vole

9.3.35 The water vole survey was repeated in 2015 to support the Environmental Statement due to the ditches being impacted by the scheme. However, during subsequent surveys it was re-evaluated as having a low quality habitat for water vole due to the high likelihood of burrows being trampled by horses in the field. There were numerous small mammal field signs, including pathways and droppings identified during the survey, however none were definitively water vole, and more likely to be the more common field vole *Microtus agrestis.* As the surveys did not identify the presence of water vole in the area, this species is scoped out and is not considered as an ecological receptor in this assessment.

Great crested newt

9.3.36 The Habitat Suitability Index (HSI) for great crested newt (GCN) was developed by Oldham et al, Evaluating the suitability of habitat for the Great Crested Newt *(Triturus cristatus)* (Ref 9.32), for evaluating pond habitat quality and the likelihood of presence of GCNs in order to inform the need for further surveys to confirm the presence and population of GCN. A HSI was undertaken as part of the phase 1

habitat survey on 27 May 2014 for the area of standing water within the disused railway line, which is the only pond within the survey area.

9.3.37 The HSI score (<0.5) indicated that the area of standing water has poor suitability for GCN and therefore no further survey was undertaken. This was further supported by the Amphibian and Reptile Conservation Trust who were consulted as part of the Stage 2 EIA process and noted no presence of GCNs in the area (See paragraph 9.2.24 for more details). As GCN are not considered to be present in the study area they are scoped out of any further assessment.

Reptiles

9.3.38 Reptiles were scoped out of the assessment during the phase 1 habitat survey as the habitat was deemed unfavourable due to high disturbance from livestock and farming, the marshy nature of the area and the lack of basking spots. Therefore reptiles are scoped out and are not considered further.

Summary of nature conservation values

9.3.39 Table 9:9 summarises the nature conservation value for each ecological receptor that is likely to be affected by the scheme and is scoped into the assessment.

Table 9.9: Summary of the nature conservation values of the ecological receptors within the study area

Receptor		**Nature conservation value**
Habitat	Rivers and streams	Within context of the route
	Marshy grassland	Local
	Standing open water	Within context of the route
	Unimproved neutral grassland	Within context of the route
	Arable land	Within context of the route
	Amenity grassland	Within context of the route
	Bare ground	Within context of the route
	Species poor hedge	Within context of the route
	Species rich hedge	Within context of the route
	Semi-improved grassland	Within context of the route
	Semi-natural woodland	Within context of the route
Species	Bat	Local
	Breeding bird	Local

Receptor		Nature conservation value
	Wintering bird	Within context of the route

9.4 Impact assessment

Temporary impacts during construction

9.4.1 Impacts arising from construction are generally regarded as temporary in nature though the period of impact is related to the time taken for habitats to be fully restored or fauna to return to the area depending upon the level of disturbance during construction. Temporary land-take will be required for welfare facilities and site compounds, however as noted in Chapter 3, there is no information available on where these are likely to be located and it is therefore not included in this assessment.

Habitats

9.4.2 The assessment identifies the habitats that will be affected by construction activities; those not included have been scoped out on the basis that there is no ecological connectivity between the receptor and the scheme (the habitats scoped into the assessment are summarised in Table 9:9).

Rivers and streams

9.4.3 The small unnamed burn which flows in a southerly direction within the western edge of Spier's Old School Ground is identified as running water within the Phase 1 Habitat Survey Report. Although priority habitat, the burn is considered to be a low value habitat and valued as within the context of the route as described in Table 9:9.

9.4.4 During construction there is a risk to the unnamed burn from pollution through the potential for spillage/leakage of fuels and chemicals adjacent to the burn. The likelihood of an impact occurring from a spillage/fuel leak is considered low with the implementation of standard control measures set out in Chapter 15 Road Drainage and the Water Environment.

9.4.5 Soils and sediments are likely to be disturbed and could result in run-off into the burn during construction. However, this impact is low due to the temporary nature of the works and the limited ecological value of burn. Overall the significance of the impact

on the unnamed burn is neutral due to the low ecological value of the water (in accordance with Table 9.2) (see Table 9:10).

Standing open water

9.4.6 The standing open water located in a small area of the disused railway will not be directly impacted during construction of the scheme but there is potential for water pollution to occur through spillage/leakage of fuels and chemicals and disturbance of soils and sediments. The impact on standing water from pollution is unlikely, with the implementation of standard control measures set out in Chapter 15 Road Drainage and the Water Environment, and would not impact any notable species. Overall, the impact on the standing open water is neutral (in accordance with Table 9.2) (see Table 9:10).

Protected species

Bat

9.4.7 Bat species use the study area for commuting and foraging, using features such as tree lines to navigate. The permanent impacts on these features from the scheme are considered in paragraphs 9.5.20 to 9.5.23. The construction activities likely to impact these routes are from disturbance due to noise from plant/machinery and lighting at existing commuting routes, and potentially close to roosts in Spier's Old School Ground and Geilsland School.

9.4.8 The category 1 tree identified south of Spier's Old School Ground does not need to be removed for the scheme, although a SuDS basin will be constructed in the area adjacent to the tree. As such there is likely to be an increase in disturbance due to construction noise around the tree.

9.4.9 The overall impact is considered to be of slight significance (in accordance with Table 9.2), as the construction works are not likely to impact the long-term distribution or population of any of the bat species identified in the area.

Breeding bird

9.4.10 Construction work undertaken during the bird breeding season is likely to cause dispersal of breeding birds in the area for the duration of the works due to a range of factors such as disturbance from noise, and vegetation loss. The scale of construction impacts is high due to the combined effects of these aspects. However, the identified

nesting and foraging habitats are abundant in the wider area construction of the scheme, and the value of bird species is considered to be of local importance. Therefore, in accordance with Table 9.2 the significance of this impact is considered to be slight (see Table 9:10).

Wintering bird

9.4.11 Non-breeding birds are likely to be impacted by disturbance from noise from construction activities. However, the surrounding landscape offers ample habitat suitable for non-breeding birds. Given the value of wintering bird species present as within the context of the route, the impact significance is considered neutral in accordance with Table 9.2 (see Table 9:10). Impacts are considered to be small scale as individual birds would disperse further afield, thereby not impacting the conservation status of non-breeding bird assemblages.

Permanent impacts post construction

9.4.12 This section considers the permanent impacts on species and habitats from the scheme, which largely arise from the irreversible loss of habitat or fragmentation of habitat affecting its viability or use.

Habitats

Marshy grassland

9.4.13 Land lost to the scheme is the main permanent impacts on habitats. This includes loss of marshy grassland (priority habitat within the LBAP, and noteworthy habitat for non-breeding birds) in the locations outlined in Table 9.3:

- The marshy grassland habitat west of Geilsland School will be entirely lost to the scheme (approximately 0.5ha)
- Marshy grassland in the north of the scheme will be lost at the south and west edge (approximately 0.4ha).

9.4.14 As there is habitat loss for noteworthy species, the scale of the impact is considered to be high; although the overall significance is slight in accordance with Table 9.2. There were only individual birds noted here and the area does not provide a large habitat to support a large population.

Unimproved neutral grassland

9.4.15 A small area of unimproved grassland is located in the north of the study area directly adjacent to the A737, and the western edge of this habitat will be lost to the scheme.

9.4.16 The unimproved grassland in question is also contaminated with Japanese knotweed and there are risks of spreading knotweed during construction if not adequately managed. The impact is overall significance is neutral due to the low value of the habitat, in accordance with Table 9.2 (see Table 9:10).

Other habitats

9.4.17 A large area of arable land will be lost to the scheme for the creation of the new Barrmill Road Roundabout and southern extent of the scheme. This is considered to be low quality land, as it is currently used for silage and is subject to high levels of disturbance from machinery. This habitat is also widely available in the wider landscape context. In accordance with Table 9.2, this is not considered an impact on key nature conservation receptors and therefore is of neutral significance, (Table 9.10).

9.4.18 Large areas of semi-improved grassland will be lost to the scheme across the study area. These areas are not considered to be high quality habitat as they are frequently used by farmers for grazing land and therefore are highly disturbed. In addition, the habitat is widely available in the broader landscape context. The impact of the scheme is therefore of neutral significance.

9.4.19 A small area of semi-natural woodland will be lost to the north of Marshland Sports Fields, the area is not considered to be of ecological importance due to the limited potential for protected species and the limited size of the habitat. The impact on this habitat is therefore of neutral significance.

9.4.20 Other small areas of habitat will also be lost, including amenity grassland, bare ground, tall ruderal land and hedgerow. These are all areas of low ecological value and the impact is therefore of neutral significance.

Protected species

Bats

9.4.21 The category 1 tree identified south of Spier's Old School Ground is not being removed, although a SuDS basin is to be constructed directly adjacent to the tree. The tree will remain in situ, as there is adequate room for the root protection area (80cm diameter tree requires a 9.6m radius from tree with an area of 290m^2) (in accordance with BS 5837:2012, trees in relation to design, demolition and construction – recommendations (Ref 9.33)).

9.4.22 Commuting routes for bats will be permanently severed by the new road particularly along Geilsland Road, and without mitigation the scale of the impact is high on commuting bats.

9.4.23 Lighting will be installed along a new section of road adjacent to Spier's Old School Ground, which has been identified as a commuting/feeding corridor for bats. As the roads are already lit in places the impact is considered to be of slight significance as bats are considered to be of local importance (in accordance with Table 9.2) (see Table 9:10).

9.4.24 The overall permanent impact on bat species from the scheme is of slight significance as the impacts will not affect the long-term distribution or abundance of bats in the area, as there are other flight paths identified that are not affected by the scheme, and potential flight paths in the wider landscape.

Breeding birds

9.4.25 The new road will likely cause breeding bird habitat severance and fragmentation. Removal of the vegetation such as trees and hedgerows will reduce the amount of habitat available for breeding birds. The loss of potential breeding habitat is approximately 700m of hedgerow, which is considered to be a high degree of change within the context of the route. However, given the amount of available habitat in the wider landscape, the habitat loss is not considered significant, and any birds inhabiting the area will be able to disperse further afield.

9.4.26 The impact on breeding birds is of slight significance as the scheme will not have an impact on the wider populations of any species in the geographical area (Table 9:10).

Wintering birds

9.4.27 As described in paragraph 9.4.13, marshy grassland habitat (0.5ha) is being lost as a result of the scheme, which has been identified as an important habitat for non-breeding birds. Wintering birds will also be impacted by severance and fragmentation due to the layout of the new road bisecting existing fields, hedgerows etc. However, given that there were only a few individual birds recorder using this habitat it is not considered important habitat for the survival of the population of any species. The impact is therefore of neutral significance (Table 9:10).

Summary of impact assessment

9.4.28 Table 9:10 provides a summary of the temporary and permanent impacts from the scheme before mitigation measures are put in place.

Table 9.10: Summary of impact significance from temporary and permanent impacts on ecological receptors

Ecological receptor	Nature conservation value	Significance of temporary impacts	Significance of permanent impacts
Habitats			
Rivers and streams	Council	Neutral	N/A
Marshy grassland	Council	N/A	Slight
Standing open water	Council	Neutral	None identified
Unimproved neutral grassland	Council	N/A	Neutral
Other habitats not identified as a priority habitat.	Within zone of influence	N/A	Neutral
Species			
Bat	Regional	Slight	Slight
Breeding bird	Regional	Slight	Slight
Wintering bird	National	Neutral	Neutral

9.5 Mitigation measures

9.5.1 Although no very large, large or moderate significant impacts were identified in the assessment, there are a number of good practice mitigation measures that will be put in place to further reduce the slight impacts of the scheme.

During construction

Habitats

Rivers and streams and Standing open water

9.5.2 Chapter 15 Road Drainage and the Water Environment describes measures to prevent and/or minimise the impact on the small burn at Spier's Old School Ground and the standing water within the disused railway line. This includes preventative and reactive measures such as bunds for fuels and the availability of spill kits on site. These mitigation measures aim to ensure no degradation in water quality of the burn and standing water.

Species

9.5.3 A pre-construction walk-over will be carried out to ensure that there no changes in the ecological baseline following publication of the ES. This walkover should take place May/June to maximise the return on seasonality of surveys.

Bat

9.5.4 The design does not require the removal of the category 1 tree, which has a high bat roost potential. However, if any changes are made to the design during construction which could affect the tree then further bat survey, mitigation and licencing will be required.

9.5.5 There will be no night time works taking place adjacent to the category 1 tree to prevent any impact on emergence behaviour of bats from temporary lighting during construction.

9.5.6 Site compounds or storage areas will not be located within the vicinity of the category 1 tree to prevent any additional disturbance from noise in the area.

Breeding bird

9.5.7 Vegetation removal will take place in winter (September to February inclusive) to avoid any impact on breeding birds, and comply with the legal requirement to avoid damage to active nests during the breeding season. Where this may not be possible a thorough nest check should be carried out by a suitably experienced ecologist no more than 48 hours prior to removal. Any nests identified at this time will need to be left until the young have fledged.

Post construction

Habitats

Marshy grassland

9.5.8 A substantial amount of marshy grassland habitat will be lost to the scheme particularly for the new Barrmill Roundabout. However, four SuDS basins will be constructed in marshy grassland areas that are designed to maintain a level of water retention all year round. The creation of the SuDS basin will be designed using input from the RSPB, *Sustainable drainage systems – maximising the potential for people and wildlife* (Ref 9.34), specifically the advice for planting which recommends measures such as:

- Choosing species which when planted together maximise flowering and fruiting to benefit invertebrates and birds
- Planted with native species of local provenance
- Planting between November and March
- Mulching to supress weed growth.

9.5.9 These SuDS basins are considered appropriate mitigation for the loss of the marshy grassland habitat. Furthermore, there are four SuDS basins across the scheme equating to approximately 1.2ha of habitat, in comparison to the 0.9ha of habitat lost, and as the habitat will be maintained (ie silt build up is removed) this is considered a positive impact.

Japanese knotweed

9.5.10 As there is potential of causing knotweed to spread (an offence under the Wildlife and Countryside Act 1981), mitigation is required to treat the infestation. As there is still time before construction (2+ years) to treat with herbicide, glyphosate would be preferable due to the drainage ditches nearby. An invasive species survey will be carried out in advance of construction and a method statement prepared to treat/remove the knotweed.

Habitat enrichment

9.5.11 Although the impact of the scheme on habitats (arable land, semi-improved grassland, bare ground, tall ruderal land and hedgerow) is not significant, the

Landscape Proposals (Drawing 25000199/100/166) has replaced these habitats with various high quality habitats. This includes small areas of woodland west and south of the new Barrmill Roundabout, small areas of maintained grassland around Barrmill Roundabout and small areas of shrub planting north of the new Barrmill Roundabout. There are also large areas of wildflower grassland proposed across the route and around the SuDS basins.

Species

Bat

9.5.12 Foraging routes will be re-instated by planting of trees/ hedgerows along roads to provide navigation points for bats. The hedgerow and woodland planting are detailed in the Landscape Proposals (Drawing 25000199/100/166) along the new road adjacent to Geilsland School and south until the disused railway.

9.5.13 Permanent lighting installation along roads and footpaths is required for health and safety. However, the level of lighting will be:

- Only where it's required due to health and safety
- Low level directional
- LEDs.

Breeding birds

9.5.14 Due to the removal of vegetation and therefore nesting and foraging habitat, the Landscape Proposals (Drawing 25000199/100/166) includes planting shrub and woodland which will mitigate for the loss.

Wintering bird

9.5.15 The SuDS basins are considered appropriate to provide suitable habitat for wintering birds. This mitigation is likely to have a beneficial impact in the long-term due to the creation of maintained habitats throughout the scheme (ie 1.2ha created relative to the 0.9ha lost).

9.6 Residual impacts

9.6.1 The mitigation described above may reduce any slight significance impacts from disturbance or habitat loss. However, as the impact assessment found no significant

impacts on ecological receptors without mitigation, the overall level of significance remains unchanged.

9.7 Statutory and planning context

9.7.1 Table 9:11 outlines the legislation, plans and policies relevant to this scheme and if the scheme achieves the objectives set out in the documents.

Table 9.11: Statutory and planning context

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
Scottish Planning Policy 2014 (Subject policy - A Natural, Resilient Place)	Subject policy – A Natural Resilient Place. The natural environment forms the foundation of the spatial strategy set out in National Planning Framework (NPF3). The environment is a valuable asset and planning plays an important role is maintaining its resources, whilst supporting sustainable use. Policy principles include: • Facilitate positive change while maintaining and enhancing landscape character • Conserve and enhance protected sites and species, taking into account of the need to maintain healthy ecosystems and work with natural processes which provide important services to communities • Promote protection and improvement of the water environment, including rivers, lochs, estuaries, wetlands, coastal waters and groundwater, in a sustainable and co-ordinated way • Seek to protect and enhance ancient semi-natural woodland as an important and irreplaceable resource, together with other native or long-established woods, hedgerows and individual trees with high nature conservation or landscape value	Areas within the study area have been identified as having potential for protected species, and high nature conservation value areas. Applicable surveys were carried out to identify any protected species or high nature conservation value areas to ensure compliance with this policy	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	• Seek to protect soils from damage such as erosion or compaction • Protect and enhance ancient semi-natural woodland as an important and irreplaceable resource, together with other native or long-established woods, hedgerows and individual trees with high nature conservation or landscape value.		
National Planning Framework (NPF) 3, 2014	The NPF is the third framework that sets out a long term strategy for Scotland. The NPF identifies areas of development and economic growth, including objectives to protect Scotland's environment by reducing waste and promoting sustainable development. The framework identifies strategies to achieve the objectives such as "*The 2020 Challenge for Scotland's Biodiversity*" (Ref 9.7).	Outlines further challenges and aims for protecting Scotland's biodiversity, primarily through initiatives such as the 2020 challenge.	Y
The 2020 Challenge for Scotland's Biodiversity	The 2020 Challenge for Scotland's Biodiversity is a response to the "*Aichi Targets (2010)*" (Ref 9.28) set out by the "*UN Convention on Biological Diversity (2010)*" (Ref 9.29) and the "*European Union's Biodiversity Strategy for 2020 (2011)*" (Ref 9.30).The 2020 Challenge aims to:	The scheme requires land-take from habitats, and without mitigation has the potential to	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	• Protect and restore biodiversity on land and in our seas, and to support healthier ecosystems • Connect people with the natural world, for their health and wellbeing and to involve them more in decisions about their environment • Maximise the benefits for Scotland of a diverse natural environment and the services it provides, contributing to sustainable economic growth.	impact wildlife. Surveys were carried out to identify any important habitats or protected species and mitigated for appropriately.	
Planning Advice Note (PAN) 60 – Planning for Natural Heritage 2000	PAN 60 provides advice on how development and the planning system can contribute to the conservation, enhancement, enjoyment and understanding of Scotland's natural environment and encourage developers and planning authorities to be positive and creative in addressing natural heritage issues.	The scheme requires land-take and without mitigation has the potential to impact natural heritage, any applicable mitigation with be enforced to prevent	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
		non-compliance"	
UK Post-2010 Biodiversity Framework	The "UK Post-2010 Biodiversity Framework" (published July 2012) succeeds the UK BAP and "Conserving Biodiversity – the UK Approach" with the purpose of setting an all-encompassing structure for action across the UK between now and 2020. The main aims of the framework are to "set out a shared vision and priorities for UK-scale activities, to identify priority work at a UK level and to facilitate the amalgamation of information on activity and outcomes across all countries of the UK".	Details the UK wide approach and Scotland's Biodiversity: It's in your hands as the apparatus for protecting Scotland's wildlife.	Y
Scotland's Biodiversity: It's in your hands (2004)	This document outlines a 25 year plan to conserve and enhance biodiversity in Scotland. With an aim "to conserve biodiversity for the heath, enjoyment and wellbeing of the people of Scotland now and in the future". There are five main objectives encompassed within this document: • Species and habitats – To halt the loss of biodiversity and continue to reverse previous losses through habitat and species action plans • People – To increase awareness, understanding and enjoyment of biodiversity, and engage many more people in conservation. • Landscapes and ecosystems – Restore biodiversity in urban, rural and	This scheme requires land-take from habitats, and without mitigation has the potential to impact species populations and ecosystems, any applicable	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	marine environments through planning, design and practice • Integration and co-ordination – develop a management framework that ensures biodiversity is taken into account • Knowledge – ensure that the knowledge on biodiversity is available to all policy makers and practitioners.	mitigation will be enforced to prevent non-compliance.	
Ayrshire Local Biodiversity Action Plan (LBAP)	The Ayrshire LBAP sets out a shared agenda for conservation action by identifying those priorities that require joint action. The aims of the LBAP are to: • Protect and enhance the natural environment of Ayrshire • Encourage local groups, organisations and individuals to work together, to conserve biodiversity The LBAP contains various Habitat and Species Action Plans. Habitats relevant to the options include farmland, grassland, wetland and woodland.	Surveys did not identify any high priority habitats or species in the area that would be impacted by the Scheme.	Y
Ayrshire Local Development Plan (LDP) 2014	The Ayrshire LDP sets out the land use plan for North Ayrshire, with an aim to guide development and investment in the area. Specific relevant policies include: • Policy ENV 1 – New development in the countryside (excluding housing), which contains criteria against which general proposals for development in	The scheme is compliant with Policy ENV 1 as it is essential public infrastructure and	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	the countryside will be determined. • Policy ENV 9 – Nature conservation, which sets out criteria against which proposals likely to affect international, national and/or local designations will be determined.	considered an exception. To be compliant the scheme will not significantly impact designated sites of European, National or of local importance.	
Wildlife and Countryside Act 1981 (Amendment) (Scotland) Regulations 2001	The Wildlife and Countryside Act 1981 amendments in 2001 consolidates and amends existing national legislation to implement the Convention of European Wildlife and Natural Habitats (Bern Convention) and Council Directive 2009/147/EC on the conservation of wild birds (Birds Directive) in Great Britain. The Act makes it an offence to intentionally or ((recklessly) – only under the Nature Conservation Act (Scotland) Act (2004)) kill, injure or take any wild animal listed on Schedule 5, and prohibits interference with places used for shelter or protection, or intentionally disturb animals occupying such places. The Act makes it an offence (with exception to species listed in	Without mitigation, the scheme has potential to impact wildlife, and spread invasive species. Applicable mitigation will be in place and method statements	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	Schedule 2) to intentionally: • Kill, injure or take any wild bird • Take, damage or destroy the nest of any wild bird while that nest is in use or being built • Obstruct or prevent any wild bird from using its nest • Take destroy an egg of any wild bird • Disturb any wild bird listed on Schedule 1 whilst it is building its nest or is, on, or near a nest containing eggs or whilst lekking • Disturb the dependant young of any wild bird listed on Schedule 1. It is an offence to "plant or otherwise cause to grown any plant in the wild out with its native range".	enforced to ensure compliance with legislation.	
Wildlife and Natural Environment (Scotland) Act 2011	The Wildlife and Natural Environment (Scotland) Act 2011 amended the Wildlife and Countryside Act 1981 and other pieces of legislation. Modernising and strengthening protection for badgers, and licensing of other protected species, and regulating invasive and non-native species.	Japanese knotweed has been identified in the area and the area has suitable habitat for protected species. Applicable	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
		mitigation will be in place and method statements enforced to ensure compliance with legislation.	
Nature Conservation (Scotland) Act 2004	The Act sets out a series of measures which are designed to conserve biodiversity and to protect and enhance the biological and geological natural heritage of Scotland. In doing so, the Act provides the principal legislative components of a new, integrated system for nature conservation within Scotland. The Act is in five parts and contributes to the new system for nature conservation by means of a combination of both new measures and amendments to existing legislation.	The mitigation to be used will reduce the impact on Scottish wildlife through construction and operation	Y
Protection of Badgers Act 1992	Badger and their setts are protected under this Act, and the Wildlife and Natural Environment (Scotland) Act 2011. Under these Acts it is an offence to: • Wilfully kill, injure, take or attempt to kill, injure or take a badger • Possess a dead badger or any part of a badger	The surrounding habitat is suitable for badger which could potentially be	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	• Cruelly ill-treat a badger • Knowingly cause or permit unlawful act relating to badger • Interfere with a badger sett by intentionally or recklessly cause or allowing: • Damage to sett or any part there of • Destruction of a sett • Obstruction of access to a sett • Causing a dog to enter a sett • Disturbing a badger while occupying a sett.	impacted by the scheme. Surveys did not find any evidence of badger in the area.	
The Habitats Directive (92/43/EEC)	The Habitats Directive (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora promotes the maintenance of biodiversity in Europe. The Directive provides for the creation of a network of protected areas across the continent, and annexes to the document list habitats and species of importance in a Europe-wide context. It is built around two pillars: the Natura 2000 network and a robust system of species protection.	Part of the assessment is to ensure that there is no impact on European designated sites and species of European importance	Y
Conservation	The Conservation (Natural Habitats &c.) Regulations 1994 regulations	The scheme had	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
(Natural Habitats &c.) Amendment (Scotland) Regulations 2012	transposed Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive) into national law. In Scotland the Habitats Directive is transposed through a combination of the Habitats Regulations 2012 (in relation to reserved matters) and the 1994 Regulations. The Regulations make it an offence (subject to exceptions) to deliberately capture, kill, disturb or trade in the animals listed in Schedule 2, or pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 4.	potential to impact protected species, surveys were carried out to identify the presence of any protected species.	

9.8 Limitations

9.8.1 The primary limitation associated with the impact on ecology is the lack of information regarding temporary land-take for site compounds, welfare facilities etc.

9.8.2 A secondary limitation was the wintering bird survey, whereby the two visits to the site were carried out within the same month. This is not thought to be a significant risk to the scheme given the low importance of the habitat in the area.

9.9 Conclusion

9.9.1 Impacts on ecological receptors from the scheme are predominantly from permanent habitat loss, specifically loss of grassland habitats. However, none of the impacts are significant due to the habitat not being of a suitable quality and size to support any large populations of important species. Additionally, with the recommended mitigation measures (such as SuDS basins and replanting) impacts on ecological receptors are will be beneficial in the longer term.

9.9.2 There will be impacts from disturbance during construction of the scheme, however this is not expected to be significant as species are predicted to disperse to the wider habitat.

10 Geology and Soils

10.1 Introduction

10.1.1 This chapter provides an assessment of the impacts of the scheme on geology and geomorphology, soils and contaminated land. The baseline conditions, potential impacts and mitigation measures associated with the scheme are identified and discussed. A description of the scheme is provided within 'Chapter 2 The Project and Alternatives Considered'.

10.1.2 This assessment is undertaken in accordance with the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 11 Geology and Soils, 1993 (Ref 10.1) methods for a stage 3 assessment. The aims of this chapter are to:

- Outline the baseline conditions
- Assess the impact of the scheme on baseline conditions
- Where appropriate, propose mitigation measures to address any potential significantly adverse impacts upon geology and geomorphology, soils and contaminated land
- Assess the residual impact of the scheme upon the baseline conditions with the proposed mitigation in place
- Determine the overall impact of the scheme in relation to geology and geomorphology, soils and contaminated land.

10.2 Methodology

Statutory and planning review

10.2.1 A desktop review of current legislation, planning policy and technical guidance was carried out to identify all relevant information to the project in relation to geology and geomorphology soils and contaminated land. Legislation was reviewed by checking the following websites:

- www.legislation.gov.uk
- www.gov.uk/government/collections/land-contamination-technical-guidance
- www.netregs.org.uk/
- www.gov.scot/Publications/Recent

- www.sepa.org.uk/regulations/

Determination of baseline

Study area

10.2.2 As the DMRB Part 11 Geology and Soils does not give buffer zones or study area guidelines, the following study areas were used for the scheme, based on professional judgement and the distance over which potential impacts could occur related to geology and ground conditions:

- 200m either side of the existing A737 and scheme was used to identify any designated sites for geological interest
- 200m either side of the existing A737 and scheme was used for identified bedrock and superficial strata and for soils
- 200m either side of the existing A737 and scheme for land capability for agriculture
- 200m either side of the existing road and scheme was used to identify any contaminated land in the vicinity of the scheme

10.2.3 These buffers are shown on Figure 10.1 Solid Geology, Figure 10.2 Drift Geology, Figure 10.3 European Soils Bureau Description and Figure 10.4 Geological and Contaminated Land Constraints. A site walkover was undertaken on 20 January 2016.

Desk study

10.2.4 A desk top review of available geological, soils, historical ordnance survey and land capability maps along with previously published reports and ground investigations regarding the scheme and its vicinity have been reviewed along with previous site walkover information. Technical reports and publically available online information sources were also reviewed. Those utilised included the following:

- British Geological Society (BGS), Hydrogeological Map of Scotland 1:625,000, 1988 (Ref 10.2)
- BGS, Groundwater Vulnerability Map of Scotland 1:625,000, 1995 (Ref 10.3)
- Macaulay Institute for Soil Research (now The James Hutton Institute for Soil Research), Soil Survey of Scotland, Firth of Clyde, Sheet 63, 1986 (Ref 10.4)
- BGS Geoindex, Geology of Britain and Borehole viewer, Mining Plan Portal and the Soil Observatory reviewed December 2015, (Ref 10.5 to 10.8)

- Coal Authority Online Gazetteer, reviewed December 2015, (ref 10.9)
- The Multi-Agency Geographic Information for the Countryside (MAGIC), reviewed December 2015, (Ref 10.10)
- Geological Conservation Review, reviewed December 2015, (Ref 10.11)
- Scotland's Soils, Macaulay Institute for Soil Research (now the James Hutton Institute for Soil Research), Land Capability for Agriculture Map (1:250,000) reviewed December 2015 (Ref 10.12)
- SNH Sitelink reviewed December 2015, available from (Ref 10.13)
- Scotland's Environment reviewed December 2015, (Ref 10.14)

10.2.5 Further information on these and all resources used in this chapter can be found within 'Chapter 20 References', Geology and Soils section.

Consultation

10.2.6 Consultation was undertaken at Stage 2 with the following statutory and non-statutory bodies:

- British Geological Survey (BGS)
- James Hutton Institute
- North Ayrshire Council
- Scottish Environment Protection Agency (SEPA)

10.2.7 Following the finalisation of the route design, they were contacted again for comments. Chapter 5 Consultation summarises the responses received and gives further information on the consultation process.

Assessment of impact

10.2.8 Any prospective road scheme can have an impact on the underlying geological resource both directly and indirectly. The Scottish Natural Heritage (SNH) guidance "A handbook on environmental impact assessment" (Ref 10.15), particularly Appendix 3: Geodiversity (Earth Heritage) and Appendix 4: Assessment of Impacts on Soils describes direct impacts as including negative effects from land-take; obscuring or removing rock outcrops; disruption of landforms, soils, hydrology and geomorphological processes, leading to permanent loss or fragmentation of geodiversity features; disturbance of natural processes both directly and indirectly (eg through the consequent need for slope

stabilisation measures or river bank protection); site restoration works that can obscure new or replacement geological sections; soil and carbon loss; contamination; structural damage; changes to soil water regime; disposal of wastes; and effects on soil biota.

10.2.9 Assessment of impacts upon geology and geomorphology and soils is undertaken through identifying the sensitivity of the features in the vicinity of the scheme and determining the magnitude of impact of the scheme. These are then combined to give the significance of impact as described in paragraphs 4.3.17 to 4.3.21. The method for assessing the impacts from contaminated land are summarised below with further details provided in Appendix 10.1.

Geology, geomorphology and soils

10.2.10 As the method of classifying the sensitivity of geological features is not provided within the DMRB Volume 11 Section 3 part 11 Geology and Soils, the assessment method defined in the DMRB volume 11, Section 2, Part 5, HA 205/08 Assessment and Management of Environmental Effects (Ref 10.16) has been adapted from a geological perspective. The sensitivity, or value, of a geological feature or resource can be defined by its nature, for example is it a designated area; its quantity, for example is it common or scarce; and by its potential for future use. Table 10.1 sets out the criteria for defining geological or geomorphological receptor sensitivity.

Table 10.1: Determination of geological and geomorphological receptor sensitivity

Sensitivity	Description
Very high	Areas containing geological or geomorphological features of international interest for example, Geoparks, Wetlands of International Importance (Ramsar sites), Special Protection Areas (SPA) and Sites of Special Scientific Interest (SSSI). Nationally important mineral deposits.
High	Areas containing geological or geomorphological features of national interest, for example National Nature Reserves (NNR).
Medium	Areas containing geological or geomorphological features of designated regional importance, for example Regionally Important Geological Sites (RIGS), worthy of protection for educational and research purposes. Regionally important mineral deposits.
Low	Geological and geomorphological features not currently protected and

Sensitivity	Description
	not considered appropriate of future protection. Absence of mineral deposits or deposits of local value.
Negligible	Limited geological features not currently protected and not considered appropriate for future protection. No mineral deposits.

10.2.11 The method of defining soil sensitivity is not provided by the DMRB Volume 11 Section 3 part 11 Geology and Soils. Reference is made within the DMRB to use of the Macaulay Institute for Soil Research (now The James Hutton Institute for Soil Research) Land Capability for Agriculture (LCA) Classification (Ref 10.12). Therefore the sensitivity of soils is defined using their agricultural classification, for example, prime agricultural land will have a higher sensitivity than non-prime agricultural land.

10.2.12 It is recognised that this method does not take into consideration the soil sensitivity of woodland areas, riverine areas or roadside areas; however as the scheme will primarily cross agricultural areas, it is considered appropriate. This method is also used within Chapter 14 Community and Private Assets. The sensitivity descriptions for soil are set out in Table 10.2.

Table 10.2: Determination of soil sensitivity

Sensitivity	Description
Very High	Land is classified as LCA grade 1, 2 and 3_1 – Land is prime agricultural land capable of producing a very wide to moderate range of crops. Land is of vital importance to the agricultural unit.
High	Land is classified as grade 3_2. Land is capable of producing a moderate range of crops.
Medium	Land is classified as grades 4_1 and 4_2. Land is capable of producing a narrow range of crops.
Low	Land is classified as grades 5_1, 5_2 and 5_3. Land is only suited to improved grassland and rough grazing.
Negligible	Land is classified as grades 6_1, 6_2, 6_3, 7 and unclassified land. Land is limited to rough grazing or of limited to no agricultural value.

10.2.13 The magnitude of impact on geology, geomorphology and soils resources are determined utilising the criteria provided in Table 4.3, within Chapter 4 Environmental

Impact Assessment Methodology defined in the DMRB volume 11, Section 2, Part 5, HA 205/08 Assessment and Management of Environmental Effects.

10.2.14 The overall significance of impact in accordance with the criteria within Table 4.4 Significance matrix, within Chapter 4 Environmental Impact Assessment Methodology. Where there are two impact significance values given in Table 4.4 (eg slight and neutral), reasoned judgement is used to determine if the impact is of a greater or lesser significance.

Contaminated land

10.2.15 The DMRB volume 11 section 3 part 11 Geology and Soils does not give guidance on how to assess the impacts from and to contaminated land. It makes reference to Planning Advice Note PAN 33 Development of Contaminated Land (Ref 10.17) for advice on assessing the impact of contaminated land. Within PAN 33, the then Scottish Executive considered the "suitable for use" approach as the most appropriate to deal with contaminated land, in a way that takes account of environmental, social and economic objectives.

10.2.16 This approach focuses on the risks caused by land contamination, and recognises that the risks presented by any given level of contamination will vary greatly according to the use of the land. The suitable for use approach consists of three elements:

- ensuring that land is suitable for its current use - in other words, identifying land where contamination is causing unacceptable risks to human health and the environment
- ensuring that land is made suitable for any new use, - assessing the potential risks from contamination, on the basis of the proposed future use and circumstances, and, where necessary, to avoid unacceptable risks to human health and the environment, remediating the land before the new use commences
- limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land - in other words, recognising that the risks from contaminated land can be satisfactorily assessed only in the context of specific uses of the land.

10.2.17 The risks posed by contaminated land are defined through the use of a Site Specific Risk Assessment (SSRA), through the development of a Conceptual Site Model (CSM). The development of the CSM follows the recommendations given with the 'Model Procedures

for the Management of Land Contamination' (CLR11) published by DEFRA and the Environment Agency (Ref 10.18) and in CIRIA's Contaminated Land Risk Assessment – A Guide to Good Practice (CIRIA 552) (Ref 10.19).

10.2.18 The CSM represents the network of relationships between potential hazards from within and adjacent to the scheme and the receptors that may be exposed to the hazards through linking pathways. Fundamental to the identification and management of land contamination risks is the concept of a pollutant linkage, comprising:

- A contaminant source – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution
- A receptor – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property or a waterbody
- A pathway – a route or means by which a receptor can be exposed to, or affected by a contaminant.

10.2.19 Each of these elements can exist independently, but only create a risk when they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway. A key element of a CSM is that not only does it examine the range of potential exposure pathways that are present; it also eliminates those pathways that are incomplete and therefore cannot pose a risk.

10.2.20 The contaminant source types, receptor types and potential pathways are defined within Appendix 10.1. The assessment of risk from contaminated land is also defined in Appendix 10.1.

10.3 Baseline conditions

Geology and geomorphology

10.3.1 Extracts of published bedrock geology and superficial geology maps are presented in Figure 10.1 Solid Geology Map and Figure 10.2 Drift Geology Map.

10.3.2 A consultation with the BGS was undertaken as part of the Stage 2 EIA. They stated that they had no comments on the proposed works. A consultation was also undertaken during this assessment; however no response has been received.

10.3.3 A site walkover was undertaken in January 2016, which indicated that the land use surrounding the scheme is primarily grassed communal parkland or undeveloped rough pasture land with areas of reeds suggesting possible marshy ground. To the west of the

current A737 lies the town of Beith with a few scattered residential properties to the east. Only land adjacent to the southbound carriageway in the south of the scheme was noted as flat lying farmland. Agricultural land use was noted to comprise pastoral grazing or silage production.

Published bedrock geology

10.3.4 The solid bedrock strata underlying Beith and most of the A737 at Beith is composed of the Beith Lava Member, a basalt, olivine-macrophyric igneous bedrock formed approximately 331 to 343 million years ago in the Carboniferous Period in a local environment previously dominated by eruptions of silica-poor magma. A fault line within this strata lies between 180 to 500m east and southeast of the current A737. Beyond this fault, along the B777 and Geilsland Road lie further deposits of the Beith Lava Member.

10.3.5 However south of Geilsland Road lie banded deposits running in a southwest – northeast direction of Blackhall Limestone, the Lower Limestone and the Hurlet Limestone Formations which formed approximately 322 to 331 million years ago in the Carboniferous Period.

10.3.6 The Beith Lava Member south runs to a geological boundary approximately 55m north of the centre of Manrahead Roundabout. South of this boundary, rock from the Kirkwood formation, volcaniclastic-sedimentary-rock (Strathclyde group), which formed approximately 326 to 335 million years ago in the Carboniferous Period, in a local environment previously dominated by explosive eruptions of magma. A third geological boundary exists roughly 330 meters southeast of Manrahead Roundabout, beyond which lie bands of the Blackhall Limestone, the Lower Limestone and the Hurlet Limestone Formations.

10.3.7 Northeast of the Barrmill Road Junction, running from Geilsland Road to the A737 in a northeast to southwest direction, lies a gully feature. The European Soil Bureau description dataset from the BGS Soil Observatory website (Ref 10.8) indicates the bedrock is at or close to the surface and is likely to be basalt.

10.3.8 As these bedrock features are neither unique nor rare and are not currently protected and not considered appropriate of future protection, the sensitivity of the bedrock to change is considered to be low.

Published superficial geology

10.3.9 The underlying superficial deposits are predominantly comprised of glacial till, of Devensian – Diamicton age, formed up to 2 million years ago in the Quaternary Period. The deposits are glacial in origin and are described as clay with variable sand and silt content with pebbles and boulders and possibly some far travelled erratics.

10.3.10 Adjacent to the area of exposed bedrock, noted above, lies a band of alluvium described as clay, silt, sand and gravel superficial deposits which formed up to 2 million years ago in the Quaternary Period. The superficial geological features are not currently protected and not considered appropriate of future protection. Although there are quarries of superficial deposits in the area, there are unlikely to be any exploitable deposits within the study area, due to the proximity of Beith. The sensitivity is therefore considered to be low.

Geology encountered during ground investigations

10.3.11 In addition to the information provided by geology maps, a number of intrusive ground investigations had also been undertaken in the area in the past. Investigations reviewed are as follows:

- Factual Report on Ground Investigation for A737 Beith Bypass – B777 Head Street Roundabout. April 2002, Aitken Laboratories Ltd, Client North Ayrshire Council (Aitken 2002)
- Factual Report on Ground Investigation for A737 Beith Bypass/B706 Barrmill Road Roundabout, March 2005, Ritchies Ltd, Client Glasgow City Council (Ritchies 2005)
- Factual Report on Ground Investigation for A737 Beith Bypass – B777 Head Street Roundabout. July 2007, Holequest Ltd, Client Glasgow City Council (Holequest 2007)
- B777 Head Street Roundabout, Geotechnical Interpretive Report, July 2007, Glasgow City Council, Client North Ayrshire Council (GCC 2007)
- B706 Barrmill Road Roundabout, Geotechnical Interpretive Report, May 2008, Glasgow City Council, Client North Ayrshire Council (GCC 2008)
- Ground Investigation at A737 Beith Bypass, Factual Report, Geotechnics Limited October 2008, (Geotechnics 2008)
- A737 Beith ByPass, Geotechnical Interpretive Report, November 2010, Amey, Client Transport Scotland (Amey 2010)

- report on ground investigation at a737 improvements, Beith, May 2015, Amey, Client Transport Scotland (Amey 2015)
- Report on ground investigation at a737 improvements, Beith, additional GI, January 2016, Amey, Client Transport Scotland (Amey 2016)

10.3.12 From these reports the following summary of ground conditions has been made.

10.3.13 Natural superficial deposits were recorded to comprise weathered glacial till over fresh till with alluvium encountered, predominantly localised to surface watercourses, comprising organic clays, silty sand and gravel or peat in limited thicknesses. The area around the Barrmill Road Junction with the A737 and the nearby Geilsland Road may have more extensive alluvial areas due to the proximity of the presence of a gully feature in the topography.

10.3.14 Buried peat was identified in the vicinity of Barmill Road, north of Wardrop Street. Peat was also identified in the areas adjacent to the gully feature north of Geilsland Road. Peat ranged in thickness from 0.3m to 1.6m.

10.3.15 Engineered fill was encountered in the boreholes drilled within the existing embankment and comprised mainly gravel sized fragments of shale with varying quantities of clay, silt and sand. The thickness of the engineered fill varied between 0.35m and 6m. It should be noted that this investigation noted the A737 embankment appears to have been constructed using un-burnt colliery spoil of predominantly shale. Non-engineered fill was also encountered up to 6.1m depth of made ground encountered comprising shale, slag, ceramics and ash.

10.3.16 Bedrock comprising predominantly igneous bedrock (basalt) was recorded across the scheme.

10.3.17 A review of all of the available geological information indicates the following sequence of strata in the study area:

- Topsoil
- Made ground (associated with the construction of the A737 and local area)
- Clay, silt, sand and gravel (alluvium) – Geilsland Road and Head Street, localised areas only; Significant buried thickness, with some peat, in Barrmill Road Junction area
- Glacial clayey sand and gravel and sandy silty gravelly clay

- Igneous bedrock (predominantly basalt)

Hydrogeology and the water environment

10.3.18 For further information on groundwater bodies and aquifers with sensitivity and impacts on hydrogeology and the water environment refer to 'Chapter 15 Road drainage and the water environment'.

Private Water Supplies

10.3.19 The BGS Geoindex database has been reviewed for current and historical groundwater wells that may indicate Private Water Supplies (PWS) or CAR licensed activities. There are no water wells within 2km of the scheme.

10.3.20 The Drinking Water Quality Regulator for Scotland (DWQR) website (ref. 10.34) has also been reviewed for any Type A PWS in the area (supply on average more than $10m^3$ of water per day, or serve more than 50 people, or supply a commercial or public activity, regardless of volume). There are no Type A water supplies within 2km of the scheme, with the nearest being at Hoodsyard Farm, 2km north east from the scheme. In addition, the DWQR indicate that Beith is a Scottish Water public supply area.

10.3.21 The PWS have been scoped out of this assessment and are not considered further. However, it should be noted that neither the DWQR nor NAC list properties supplied by Type B PWS (domestic supplies providing less than $10m^3$ of water per day, or supplying less than 50 people) and that there are seven wells and two springs shown on OS maps within 2km of the scheme. Additional land owner and SEPA consultations should be held at the detailed design stage to determine if these are PWS or CAR licensed activities and their status.

Groundwater dependant habitats

10.3.22 There are two areas which may be groundwater dependant habitats described within Chapter 9 'Ecology and nature conservation' within 2km of the scheme. They comprise marshy grassland, within an area west of Geilsland School and a larger area in the northern extent of the survey area, opposite Thomson of Beith Garage. These have been scoped out of the ecology assessment on the basis that there is no ecological connectivity between the receptor and the scheme. They are also not considered to be groundwater dependant habitats and so have also been scoped out of this assessment and not considered further.

Contaminated Land Receptors

10.3.23 Groundwater and surface water are discussed in this chapter in relation to contaminated land and that the surface water bodies, groundwater bodies and sub-surface aquifers are likely to be contaminated land receptors. For further information on sensitivity and impacts on hydrogeology and the water environment refer to 'Chapter 15 Road drainage and the water environment'.

10.3.24 The scheme lies within the vicinity of two bedrock groundwater bodies, the Beith groundwater body (north of the Manrahead Roundabout – SEPA ID: 150588) and the Dalry groundwater body (south of the Manrahead Roundabout – SEPA ID: 150578).

10.3.25 As per Table 3 within Appendix B, and in accordance with SEPA guidance 'Assigning Groundwater Assessment Criteria for Pollutant Inputs' (SEPA 2014, WAT PS 10, version 3.0) (Ref 10.33), all bedrock groundwater is considered to have resource potential and hence is considered a contaminated land receptor.

Designated areas

10.3.26 A review of SNH's Sitelink website, the MAGIC website and the Joint Nature Conservation Committee (JNCC) Geoconservation website indicates that there are no areas designated for their geological features within 200m of the scheme. Accordingly, areas designated for their geological or geomorphological importance are scoped out of this assessment and are no longer considered. It should be noted however, that the Trearne Quarry Site of Special Scientific Interest, designated for its Lower Carboniferous (Dinantian – Namurian) geology lies 1.2km east of the scheme and encompasses an active limestone quarry. The scheme may reveal new geological strata that may be worthy of geological review.

Mining

10.3.27 A review of the North Ayrshire, East Ayrshire and South Ayrshire Mineral Resources information for sustainable communities map (Ref 10.25) indicates that there are superficial deposits of brick clay (common shale for brick and common shale for brick coincident with areas of shallow coal), superficial deposits of sand and gravel (sub-alluvial and river terrace deposits: inferred resources), bedrock deposits of crushed rock aggregate (igneous rocks including basalts, dolerites, trachytes and andesites) and bedrock deposits of limestone.

10.3.28 The BGS Geoindex indicates that there are no active mineral extraction sites within 200m of the scheme.

10.3.29 The Interpretive Report produced by Glasgow City Council states that it is considered, given the nature of the underlying rocks, that the presence of historical sub-surface mineral workings underlying the site is highly unlikely. In addition, as part of this Interpretive Report, an Underground Mining Subsidence Report was obtained from the Valuation Office Agency (dated May 2008). This report concluded that the risk of damage to the site from underground mining subsidence was minimal and the site was not considered to be affected by past quarrying activities.

10.3.30 Furthermore, as part of the desk study produced by Amey, a Coal Authority Mining Report was obtained (dated June 2010). This report concluded that the site is not within the zone of likely physical influence of past underground workings and is not at risk from any proposal for future underground coal workings.

10.3.31 No recent mineral extractions are indicated to have been carried out within the study area. The nearest examples of historic mineral extraction comprise a sandstone quarry adjacent to Marshyland Farm indicated on the 1858 historical OS map 75m southeast of the scheme and an old Whinstone quarry south of Manrahead roundabout (150m south of the scheme, also indicated on the 1858 OS map.

10.3.32 Any new road scheme will prevent access to exploitable mineral deposits beneath the road route. The sensitivity of the study area from a mining perspective has therefore been assessed as low as although there are regionally important mineral deposits in the area, they are not unique or rare. In addition, the locality of Beith indicates that future exploitation of mineral deposits in the area would be unlikely. As such, the impacts on mineral assets are scoped out and are not considered further.

Geomorphology

10.3.33 Geomorphology describes the way physical features (eg physical, chemical or biological processes) of the surface of the earth relate to its geological structures eg how glaciation forms much of the landscapes of Scotland.

10.3.34 The study area lies within a pre-glacial valley, which passes from the Clyde to the Ayrshire coast. The valley was further deepened and widened to its current form through glaciation and is now filled with glacial till and modern alluvium. The valley base once formed a large flood plain with a large loch (Garnoth Loch); however a long history of agriculture and land drainage has reduced this to Kilbirnie Loch, Barr Loch and Castle

Semple Loch. The geological landscape within the study area is a relatively stable, broad lowland valley which is neither rare nor unique and is considered to have a negligible sensitivity. As the landscape has already been highly modified by human activity, it is considered that the scheme will have no additional impact and so the impacts on geomorphology are scoped out and are not considered further.

Soils

Soils description

10.3.35 The BGS Soil Observatory has indicated that under the Soils of Scotland dataset, the soils of much of the scheme lie within the Kilmarnock soil group (map unit 331), (brown noncalcareous gleys forest soils with gleying; some noncalcareous and humic gleys). To the west of Beith and south of Manrahead Roundabout lies soils of the Ashgrove group (map unit 150), (noncalcareous gleys; some peaty gleys, humic gleys and peat). To the north of the Roebank Road / A737 junction and to the northeast lies soils of the Darleith soil group (map unit 40), (brown forest soils; some brown forest soils with gleying).

10.3.36 The Kilmarnock and Ashgrove soil groups can be further categorised as being stagnosols which are soils characterised by stagnating water and structural or moderate textural discontinuity. The Darleith group is further categorised into cambisols which are characterised by the absence of a layer of accumulated clay, humus, soluble salts, or iron and aluminum oxides which, because of their favourable aggregate structure and high content of weatherable minerals, they usually can be exploited for agriculture; and umbrisols which are characterised by a surface layer that is rich in humus but not in calcium available to plants, owing to high rainfall and extensive leaching that lead to acidic conditions.

10.3.37 The BGS Soil Observatory also has the European Soil Bureau description dataset which indicates the soils within the study area as glacial till with riverine clay and floodplain sands and gravel north of Wardrop Street and north of Geilsland Road with an area of exposed basalt also north of Geilsland Road.

10.3.38 Extracts of published European Soil Bureau map are presented in Figure 10.3 European Soil Bureau description map.

Land capability for agriculture classification

10.3.39 Extracts of published Land Capability Classification maps are presented in Figure 14.1 with further information in Chapter 14 Community and Private Assets.

10.3.40 The Macaulay Institute for Soil Research (now James Hutton Institute) Land Capability Classification maps have classified land to the east of Beith encompassing the study area as being Grade 3_2, (non-prime agricultural land capable of producing a moderate range of crops, principally grass, arable and forage crops, with an increasing trend towards grass in the rotation). Land comprising the town of Beith (within the A737) is unclassified.

10.3.41 Land to the north of the Roebank Road / A737 junction has been classified as being Grade 4_1, (non-prime agricultural land is capable of producing a narrow range of crops with enterprises based on grassland with short arable breaks). To the south of Manrahead Roundabout, land has been classified as being Grade 4_2, (non-prime agricultural land capable of producing a narrow range of crops, especially grass but harvesting may be difficult).

10.3.42 The site walkover indicated that agricultural land was currently used for pastoral grazing of horses, beef and dairy cattle and for silage production. Further information can be found within Chapter 14 Community and Private Assets.

10.3.43 A consultation with the James Hutton Institute was undertaken as part of the Stage 2 EIA. They indicated at that time, that there was no prime agricultural land within the study area and that they had no objections to the options from an agricultural or geological viewpoint. A consultation was undertaken with James Hutton Institute during this assessment; however no response has been received.

10.3.44 Although Table 10.2 indicates that land classified as 3_2 should have a high sensitivity, based on the site walkover information and that the soil groups and descriptive units are not considered rare or unique, are not currently protected and not considered appropriate of future protection, their sensitivity has therefore been assessed as low.

Contaminated land

10.3.45 A consultation undertaken with North Ayrshire Councils Contaminated Land Officer and Petroleum Officer has indicated that there is one petroleum site within the study area and that earth removal or vibrations works undertaken close by should be carried out with due consideration. In addition, any water dispersal in the vicinity should be kept to a minimum. Although NAC do not name the petroleum site, it is assumed to be the Thomson of Beith garage.

Historical contamination sources

10.3.46 An Envirocheck report covering both the B706 Barrmill Road and the adjacent A737 Beith Bypass scheme was obtained in June 2010 as part of the Amey Geotechnical Interpretive Report. This report contained historical Ordnance Survey (OS) Sheets which provided sufficient detail to allow review of the historical development of the area covering the scheme now proposed.

10.3.47 There have been several potentially contaminative land uses in the area including the Glasgow and Kilmarnock Joint Railway line, cabinet works, a net factory, ropery, tannery, garages and three cabinet works.

Geochemical analysis

10.3.48 Geochemical analysis was undertaken during the 2014 Amey ground investigation for inorganic and organic determinant. Seventeen soil samples taken from across the scheme area were analysed for soils determinant with four soil samples analysed for Waste Acceptance Criteria (WAC) determinant.

Soils analysis

10.3.49 Due to the low number of samples taken compared to the size of the study area, this assessment can only be used to give an indication of likely soil conditions. Two samples were found to have nickel concentrations in excess of soil guideline values for a residential land use (used to assess risks to construction workers) published by the Environment Agency (Ref 10.26).

Leachate analysis (groundwater assessment)

10.3.50 There were no groundwater samples taken under any ground investigation. Therefore an analysis of groundwater has been undertaken using leachate results. As part of the WAC analysis, four soil samples were subjected to leachate abstraction. In the absence of groundwater samples and geochemical analysis, these leachate analysis results have been compared to assessment criteria obtained from the Scotland River Basin District (Standards) Directions 2014, The Public Water Supplies (Scotland) Regulations 2014 and the WHO Guidelines for Drinking Water Quality, Third edition 2004. This comparison showed that there was one sample in excess of criteria for lead, three samples for copper and two samples for zinc.

WAC analysis

10.3.51 Samples analysed for WAC determinants showed that two out the four samples gave results which indicated the soils would be acceptable at an inert landfill, with the remaining two samples indicating soils would be acceptable at a Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill.

Ground gas

10.3.52 Previous investigations included soil gas monitoring which recorded concentrations of methane and carbon dioxide in made ground which were elevated above typical background levels. The source of the gas is likely to be from the made ground, the buried peat and organic clay/silt.

10.3.53 There was a single round of gas monitoring undertaken during the Amey 2014 investigation. Methane and carbon dioxide were not recorded above the detection limits of the gas analyser and gas flow levels were also not recorded above the detection limits.

10.3.54 There were six rounds of monitoring undertaken during the Amey 2015 investigation which did not find methane at concentrations greater than the detection limit. Maximum concentrations of carbon dioxide of 1.1% v/v and maximum gas flow rate of 10.4 litres per hour (l/hr) were found in borehole 15BH02.

10.3.55 Assuming that the methane concentrations are the detection limits of the analyser (0.1%v/v), the advice provided in the National House-Building Council (NHBC) document "Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present" (Ref 10.27), indicates a gas screening value for methane of 0.01 and for carbon dioxide of 11.44.

10.3.56 Assuming a worse-case scenario gas screening value of 11.4, then a characteristic situation of level 3 can be assumed indicating a moderate risk from ground gas.

Current contamination sources

10.3.57 Currently, the only other major forms of development other than agricultural in the area comprise the following:

- The existing A737, B706 and local road network
- Two garages (a fuelling station and mechanics garage) adjacent to the A737, north of Wardrop Street

- An electrical substation at the corner of the A737 and Geilsland Road, indicated on maps from 1970 onwards. Site surveys indicate that this building has been demolished, leaving only a concrete footprint. It is not known if the subsurface infrastructure remains or if Construction Design and Management (CDM) demolition plans were maintained

Potential contamination from made ground encountered during previous ground investigations.

10.3.58 From the historical and current land uses, it is possible to assemble a list of potential contamination sources within 200m of the study area, as shown in Table 10.3.

10.3.59 These sources are shown on Figure 10.4 Contaminated Land and Geotechnical Constraints. Further information can be found in Appendix 10.1.

Table 10.3: Contamination sources

No	Source of contamination
S1	Existing A737, B706, local road network (including embankments)
S2	Garages
S3	Derelict Electrical Substation
S4	Former Glasgow and Kilmarnock Joint Railway line, station and depot.
S5	Former Cabinet Factory
S6	Previous Buildings and Infrastructure – Electrical substation, Scout Hall, Residential garage
S7	Made Ground identified from ground investigations (area east of the Head Street / Wardrop Street Junction)
S8	Made Ground and geochemical exceedances identified from ground investigations (amenity area north and east of the B706 / Geilsland Road Junction)
S9	Made Ground identified from ground investigations (area east and west of the Former Glasgow and Kilmarnock Joint Railway line)

10.3.60 Annex 3 of the NHBC Guidance for Safe Development of Housing on Land Affected by Contamination (Ref 10.28) presents a comprehensive listing of the most significant contaminants associated with a range of former land uses. The potential contaminants that may be found for land uses such as former railway land, roads, electrical substations

or garages may include metals and metalloids (arsenic, cadmium, chromium, copper, lead, mercury, nickel, vanadium and zinc) inorganic contaminants (cyanide (free), nitrate, sulphate, sulphide, asbestos, boron and elevated or depressed pHs) and organic contaminants (phenol, oil/fuel hydrocarbons, aromatic and aliphatic hydrocarbons, polycyclic aromatic hydrocarbons, chlorinated hydrocarbons, poly-chlorinated biphenyls, dioxins and furans, organo-lead compounds and organo-tin compounds).

SEPA registers

10.3.61 A review of SEPA's website has indicated there are no landfill sites within the study area.

10.3.62 As noted in Table 15.6 of Chapter 15 Road drainage and the water environment, there are numerous road construction activities which will be carried out as part of the scheme which will require registration or licencing, including possible dewatering, work on culverts and the installation of SuDS basins. As such the scheme is likely to require a licence under the Water Environment (Controlled Activities) (Scotland) Regulations.

10.4 Impact assessment

Impacts on geology

Temporary impacts during construction

10.4.1 With regards to underlying geology and geomorphology, there will be limited impacts during construction as the primary impacts would be permanent through earthworks (cuttings and embankments). During construction the impacts will include the following:

- Compaction of superficial strata along haulage routes
- Compaction of excavated materials within storage areas from increased levelling and grading of areas of the construction site will result in lower permeability and therefore decrease infiltration and increased runoff
- Temporary excavations for the construction of foundations, culverts, and other structures
- Excavations of material from cuttings and storage prior to treatment and use in embankments or disposal
- Increased erosion by concentrating surface water flows and removing the natural erosion protection (vegetation cover), as well as increasing run-off as well as reducing infiltration and groundwater recharge

- Increased wind erosion of excavated materials around cleared areas, haulage roads and buildings (site compound and accommodation).

10.4.2 There will be no temporary impacts on the superficial and bedrock geology with the magnitude of impact being assessed as no change and the significance of impact as neutral.

Permanent impacts post construction

10.4.3 The main permanent impact of the scheme to the underlying geology will be through earthworks. The cutting depths and embankment heights range from 2.84m below existing road profiles to 5.51m above existing road profiles. Considering that the depth to bedrock during the ground investigations was less than 5m, it is considered likely that bedrock will be encountered within the cuttings. In addition, it is not currently known to what depth foundations for the footbridge will be; however it is considered that they will be sited on bedrock. The earthworks of the scheme are set out in Table 10.4, based on estimates from the scheme design.

Table 10.4: Estimated Earthwork Quantities

Type of Earthworks	**Volume (m^3)**
Total excavation required	62,467 including 53,932 from cutting excavation
Total acceptable excavation	32,359
Total unacceptable excavation*	30,108
Total fill required	29,851
Landscape fill (from unacceptable excavated material)	8,300
Imported fill	-2,508 indicating no import of fill required.
* The design engineers have assumed that the upper 2m of excavated material is unsuitable for reuse. This applies over the entire earthworks footprint from Geilsland Road northwards. From Geilsland Road southwards, the upper 1m would be unsuitable but the rest would be re-usable as-dug or with lime modification. In addition, from excavated material deeper than 1 and 2m, it has been assumed that 60% will be suitable for reuse.	

10.4.4 It is considered that the magnitude of impact on the superficial and bedrock geological strata is moderate as there will be substantial permanent changes to the underlying geology. The significance of this impact is slight.

10.4.5 A potential positive impact post construction on sites designated for their geological or geomorphological features could be through revealing new rock strata for scientific study or research, particularly with the Tearne Quarry SSSI 1.4km east of the study area. Approximately one third of geologically designated sites are man-made, with many as a result of quarrying activity.

10.4.6 The permanent magnitude of impact on the superficial and bedrock geology are assessed as moderate with the significance of impact as slight, as the earthworks will have a permanent impact on the geology through cuttings and embankments.

Impacts on soils

Temporary impacts during construction

10.4.7 Soils act as an important carbon store through the accumulation of organic matter. Soil disturbance can result in loss of carbon to the atmosphere, leading to an increase in greenhouse gas emissions; the loss of soil structure and the loss of soil biodata. During construction the impacts will include the following:

- Compaction of soils along haulage routes and over-compacting soil through the use of heavy machinery or the storage of construction materials
- Compaction of excavated materials within storage areas from increased levelling and grading of areas of the construction site will result in lower permeability and therefore decrease infiltration and increased runoff
- Contaminating soil as a result of accidental spillage or the use of chemicals
- Reducing soil quality, for example by mixing topsoil with subsoil or by mixing it with construction waste or contaminated materials, which then have to be treated before reuse, disposed of at landfill or have fresh topsoil imported
- Soil erosion around cleared areas, haulage roads and buildings (site compound and accommodation) through wind operations or by concentrating surface water flows and removing the natural erosion protection (vegetation cover), as well as increasing run-off as well as reducing infiltration and groundwater recharge.

10.4.8 The impacts on soils during construction are assessed as moderate. As the sensitivity is low, the significance of impact is slight.

Permanents impact post construction

10.4.9 The permanent impacts on the soils resource from the scheme include:

- Loss of soil matter through wind erosion or surface water runoff, resulting in increased potential for flooding
- Compression of peat with a drainage blanket and surcharge in advance of pavement construction, although bulk peat excavations are not planned which will reduce the impact
- Soil compaction leading to increased potential for flooding and loss of soil matter through erosion
- Inadequate identification of clean soil resources resulting in the need to import soil for landscape works
- Soils adjacent to the completed road, may be affected by spray, runoff or airborne pollutants
- Covering soil with impermeable materials, such as asphalt, effectively sealing it and resulting in impacts on the physical, chemical and biological properties, including drainage characteristics.

10.4.10 In addition, there may be indirect impacts including the mobilisation of soil matter to watercourses resulting in sedimentation; however this is considered in greater depth within Chapter 15 Road Drainage and the Water Environment.

10.4.11 The permanent impacts on soils are assessed as moderate, and as the sensitivity is low, the significance of impact is slight.

Impacts to and from contaminated land

10.4.12 A CSM has been compiled for the contamination sources and pathways within Appendix 10.1. It should be noted however, that there are several uncertainties within the contaminated land assessment including:

- the geochemical makeup within made ground and natural deposits
- the quantity and flow characteristics of surface water and groundwater
- the geochemical makeup within the groundwater beneath the site

- the gas regime on site.

10.4.13 The CSM indicates that potential risk from contaminated land ranges from moderate to low during construction (temporary) and from moderate to low to very low post construction (permanent).

10.5 Mitigation measures

Geology

During Construction

10.5.1 To reduce the impact of compaction of superficial strata during construction, haul routes should be no wider than necessary to accommodate two passing vehicles and should be stripped of soil down to a firm base. Indiscriminate vehicle movements across the scheme area should be avoided and vehicles should use existing asphalt road wherever possible.

10.5.2 Where possible, all excavated earthwork material should be re-used on site and works should be scheduled to allow for the maximum amount of excavated material to be reused. The glacial till present around much of the study area is likely to require geotechnical or geochemical treatment to be suitable for re-use as embankment fill or landscaping. Any excavated material should be reused as soon as possible after exaction to reduce the potential for windblown dust.

10.5.3 The expected earthworks quantities are provided in Table 10.4. It shows that there would be 62,467m^3 (including 53,932m^3 from cutting excavation) of total excavation required. Out of this 32,359m^3 would be acceptable for reuse, 30,108m^3 would be unacceptable excavated material (assuming that the upper 2m of excavated material is unsuitable for reuse from Geilsland Road northwards; from Geilsland Road southwards, the upper 1m would be unsuitable but the rest would be re-usable as-dug or with lime modification. In addition, from excavated material deeper than 1 and 2m, it has been assumed that 60% will be suitable for reuse.). There will be a requirement for 29,851m^3 of fill, of which 8,300m^3 of landscape fill would be required from unacceptable excavated material. These estimated volumes indicate the earthworks balance to be -2,508m^3 which indicates that no import of fill materials will be required.

10.5.4 The preparation of a Materials Management Plan (MMP) would allow for material to be excavated, treated (were required) and reused in the most efficient way. In addition,

damping down of haulage roads and work areas (eg site compound and storage areas) would also reduce the potential for windblown dust.

10.5.5 By covering excavated material before reuse or by preventing / intercepting surface water runoff, the erosion of fine soil particles can be reduced which can also reduce any sedimentation of watercourses and reduce windblown erosion.

10.5.6 By following the guidelines given in DEFRA's 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites' (Ref 10.29) documents, impacts related to compaction of excavated materials within storage areas can be reduced and mitigated.

Post Construction

10.5.7 The development of a Site Waste Management Plan (SWMP) during the detailed design stage would maximise use of existing resources, reducing the amount of material required from off-site sources; and reduce waste materials being transported off site. The use of these plans will also have associated benefits by reducing costs of transport and sourcing fill materials. Brownfield soils, eg demolished buildings/infrastructure, the current road network and materials not suitable for reuse (eg excavated soils and rocks) would usually be sent to either a Materials Reclamation Centre or to a waste disposal site. Waste Characterisation Analysis and the use of reuse criteria should be undertaken to maximise the quantities of soil material recycled. This would form part of a Materials Management Plan (MMP), and included in the SWMP.

Soils

During Construction

10.5.8 During construction, impacts on soils can be mitigated through good working practices including the following.

- Control of dust generation through damping-down with clean water during dry and/or windy periods
- Haul routes should be no wider than necessary to accommodate two passing vehicles and should be stripped of soil down to a firm base. Indiscriminate vehicle movements across soil should be avoided
- Soils should be stored according to guidelines given within the 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites'

- All fuel and chemical storage areas should be on hardstanding and be bunded to prevent leaks escaping to the soils environment.

Post Construction

10.5.9 To mitigate long term and permanent impacts, wherever possible, all excavated soils should be re-used on site rather than disposed of and importing virgin soils. A Soil Resource Plan (SRP) should be created for the scheme and will normally form part of the MMP for the scheme. It should include the following:

- maps showing topsoil and subsoil types, and the areas to be stripped and left in-situ
- methods for stripping, stockpiling, respreading and ameliorating the soils
- location of soil stockpiles and content (eg Topsoil type A, subsoil type B)
- schedules of volumes for each material
- expected after-use for each soil whether topsoil to be used on site, or sent off site, or subsoil to be retained for landscape areas, used as structural fill or for topsoil manufacture
- identification of persons responsible for supervising soil management.

10.5.10 The 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites' contains guidelines and case studies that should be used when considering and designing the SRP.

Contaminated land

During Construction

10.5.11 The risks from contaminated land can be reduced through the application of several measures including the following.

- Additional ground investigation including soils and groundwater sampling and ground gas monitoring should be undertaken at the detailed design stage. The additional information would then be used to refine the CSM to reduce the risks posed by contaminated land and to prepare reuse criteria that would be protective of the environment and human health.
- Appropriate health and safety and waste management procedures for working with potentially contaminated soils should be established, eg risks to construction workers

can be mitigated by the adoption and use of appropriate personal protective equipment.

- By following the guidelines given in the Environment Agency's 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination, Guidance on Pollution Prevention' (Ref 10.30) potential impacts caused by creating pollution pathways from contaminated land to underlying water bodies can be reduced.
- Access to areas identified as contaminated should be restricted during construction.
- To reduce the potential for cross contamination across the site, areas identified as contaminated would be demarcated both in the field and in drawings so that excavated material can be handled separately from greenfield material as there may be different reuse requirements.
- Re-use criteria will be developed at the detailed design stage in accordance with SEPA's Land remediation and waste management guidelines based on the principles that the reuse of the soil will not result in pollution of the environment (particularly the water environment) or harm to human health.
- A 'watching brief' should be enforced during construction in order to take account of the fact that there may be isolated pockets of previously unidentified contamination
- Gassing issues should be assessed at the detailed design stage in accordance with CIRIA 665 and with the Health and Safety Executive work exposure limits and a ground gas monitoring program should be produced

Post Construction

- Environmental quality criteria protective of end users should be developed to support reuse of contaminated excavation arisings including the use of clean cover and vegetation on embankment areas constructed using excavation arisings
- An MMP should be developed to track the excavation, storage and final placement of potentially contaminated arisings
- A soil reuse assessment should be undertaken in order to identify any potential risks posed to the water environment from potentially contaminated soils used in embankments and associated structures
- Prior to disposal, soils will be assessed to determine whether they are hazardous or non-hazardous

- Reference to appropriate guidance in the selection of construction materials such as Building Research Establishment (BRE) SD1:2005 Concrete in aggressive ground (Special Digest 1) (Ref 10.31) and British Standard (BS) BS8500 'Concrete, Method of specifying and guidance for the specifier' (Ref 10.32) where concrete materials are proposed.

10.6 Residual impacts

10.6.1 Through the use of the mitigation measures stated above, the impacts of the scheme are reduced; however, there are still likely to be impacts on geology and soils. A summary of the residual impacts after mitigation for both during and post construction is set out in Table 10.6.

Table 10.5 Summary of impacts

Receptor	Sensitivity	Phase	Magnitude of impact	Significance of impact
Bedrock and superficial geology	Low	Construction	No change	Neutral
		Operation	Moderate	Slight
Soils	Low	Construction	Moderate	Slight
		Operation	Moderate	Slight

10.6.2 For contaminated land, with the implementation of mitigation measures, the likelihood of a pollutant pathway between a contamination source and a receptor is reduced; which will reduce the impact so that the risks during construction (temporary impacts) are low to moderate to low and post construction (permanent impacts) are low to very low.

10.7 Statutory and planning context

10.7.1 Following the assessment of impact in section 10.6, the scheme has been assessed against the various relevant policies applicable to the scheme. The results are shown in Table 10.7.

Table 10.6: Statutory and planning context

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
The Environmental Protection Act 1990 (ref 10.20)	This Act established businesses' legal responsibilities for the duty of care of waste, contaminated land and statutory nuisance. This is detailed further within the Part IIA Contaminated Land – Statutory Guidance: Edition 2 (ref 10.21).	An assessment of impacts from the scheme to local residents from geology and contaminated land has been undertaken.	Yes
The Contaminated Land (Scotland) Regulations 2005 (ref 10.22)	Legislation for cleaning up contaminated land with the main responsibility for enforcing the regime lies with the local authority. This legislation introduces a risk assessment methodology to be used in assessing whether a site is contaminated or suitable for use.	A conceptual site model has been created to assess the impact of contaminated land. Consultations have been undertaken with North Ayrshire Council's Contaminated Land Officer and Petroleum Officer.	Yes
PAN 33 – Development of Contaminated Land 2000 (ref 10.17)	This planning advice note states that the planning system has a key part to play in addressing the problem of historical contamination. In pursuing policies to re-use and redevelop sites, developers and planning authorities need to be aware of contamination issues and the role of the planning system in dealing with them.	A historical map review has been undertaken to identify any historical sources of contamination. In addition, a consultation has been undertaken with North Ayrshire Council's Contaminated Land Officer and Petroleum Officer.	Yes
The Scottish	The Scottish Government aims to promote	The scheme will include the stripping	Yes

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
Soil's Framework 2009 (Ref 10.23)	sustainable management and protection of soils, consistent with the economic, social and environmental needs of Scotland. Environmental impacts such as climate change and soil organic matter loss can cause soil degradation, leading to erosion, compaction, loss of biodiversity and nutrient leaching.	and removal of several layers of topsoil and sub-soil. James Hutton Institute and North Ayrshire Council have been consulted.	
North Ayrshire Local Development Plan 2014 (Ref 10.24)	Policy ENV 4 'Farmland' which seeks to protect prime quality agricultural land from development	Parts of the scheme will run through non-prime agricultural farmland. James Hutton Institute consulted.	Yes
	Policy ENV 9 'Nature Conservation' which sets out criteria against which proposals likely to affect international, national and/or local designations will be determined	There are no designated areas either beneath the footprint or within 2km of the scheme.	Yes
	Policy ENV 10 'Mineral Extraction' which sets the framework for determination of proposals for mineral extraction	There are mineral extraction industries north and south of Beith. Consultations with BGS and the coal authority have been undertaken to ensure mineral resources were protected.	Yes

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	Contaminated land is addressed as part of Policy ENV 4, Policy ENV 10 and Policy PI 7 (Waste Management)	A historical map review has been undertaken to identify any historical sources of contamination. In addition, a consultation has been undertaken with North Ayrshire Council's Contaminated Land Officer and Petroleum Officer.	Yes

10.8 Limitations

10.8.1 The assessment of impacts is limited due to a lack of construction information, eg foundation depths of the pedestrian footbridge. In addition, construction site plans are unavailable and it is unknown where site and storage compounds are to be and where haulage roads will run. The impacts have therefore been determined using generic information.

10.8.2 As stated within the hydrogeology section, there has been a lack of information regarding Type B PWS and CAR licensed activities. Consultations shall be undertaken with SEPA and NAC by the contractor to determine if there are any PWS and CAR licensed activities within 2km of the scheme. However, based on the underlying geology, the depth of groundwater in the area and the depth of cuttings, it is unlikely that the impact will change following these consultations.

10.8.3 There has been limited ground gas monitoring, groundwater and surface water quality information obtained within the study area, with limited geochemical information from soils and geology. Additional investigations shall be undertaken to ascertain the geochemical regime within the study area at detailed design stage to further delineate the potential contaminated land risk and to define mitigation measures. The risks from contaminated land have been assessed on a 'worst case scenario' basis to allow for any uncertainties the lack of information presented.

10.9 Conclusion

10.9.1 There will be temporary and permanent impacts of slight significance to superficial and bedrock geological deposits and soils from the scheme. There will be no impacts to designated sites, mineral deposits and to geomorphology both during construction and with the scheme in place. There may be a positive impact on sites designated for their geological or geomorphological features as new rock strata could be revealed through the scheme for scientific study or research.

10.9.2 There will be low to moderate to low risks of a complete pollutant pathway from contaminated land during construction and moderate to low to very low risks with the scheme in place. The primary pollutant pathway risk is from migration of ground gas.

11 Materials

11.1 Introduction

11.1.1 This chapter assesses the impacts associated with material use in the construction of the scheme (as described in Chapter 3), as well as the handling and disposal of waste produced by construction works and considers whether there are likely to be significant resource implications from the scheme. Most schemes will require the acquisition and use of primary raw materials and manufactured products, and during construction this scheme will require large quantities of raw materials, the use of which has the potential to cause adverse impacts such as the depletion of natural resources.

11.1.2 The operational impacts of the scheme are not assessed as it is not considered that there will be significant impacts from material use or waste generation at this stage. The assessment has been undertaken in accordance with the guidance set out in Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Environmental Assessment (Ref 11.1), in conjunction with Interim Advice Note (IAN) 153/11, Guidance on the Environmental Assessment of Material Resources (Ref 11.2).

11.1.3 On complex capital maintenance, improvement or large new construction schemes IAN 153/11 recommends a detailed assessment of the environmental consequences of the scheme to inform project decisions. As this scheme involves large sections of new construction on agricultural land, a detailed assessment is considered appropriate.

11.1.4 Materials are assessed in this chapter through the review of the following:

- Material use – the potential environmental effects that are associated with the extraction and transport of primary raw materials, the manufacture of products, and their subsequent transport to and use on construction sites. Material resources for schemes such as this as described in Table 11.3, include primary raw materials, such as aggregates and minerals; and manufactured construction products including recycled and secondary aggregates. Many material resources may originate offsite, purchased as construction products and some arise onsite such as excavated soils or recycled road planings. Materials shall be selected in accordance with Volume 1 of the Manual of Contract Documents for Highway Works (MCHW) - Specification for Highway Works (SHW) which contains the material specifications required in all components of the construction, improvement or maintenance of the Scottish Trunk Road network.

- Waste management – the potential environmental effects that are associated with the production, movement, transport, processing, and disposal. Waste is defined in Article 1(a) of the European Waste Framework Directive 2008/98/EC (Ref 11.3) as "any substance or object in the categories set out in Annex I which the holder discards or intends to discard or is required to discard". The term "holder" is defined as the producer of the waste or the person who is in possession of it and "producer" is defined as anyone whose activities produce waste. Waste can be further classified as hazardous, non-hazardous or inert.

11.1.5 It is outside the scope of IAN 153/11 to assess the potential environmental impacts that are associated with the extraction and transport of primary raw materials, the manufacture of products. It is acknowledged in IAN 153/11 that the extraction and transport stages of a materials lifecycle will already have been subject to an environmental assessment.

11.1.6 Instead the assessment concentrates on the impacts that will occur as a result of the use of primary, secondary and recycled raw materials and manufactured construction products on the project. However, it should be noted that the environmental credentials for any materials consumed by the scheme, for example the carbon footprint and sustainability statistics, shall be taken into consideration by the contractor when evaluating their choice.

11.2 Methodology

Determination of baseline

Study area

11.2.1 For materials and waste, the study area is taken to be the construction area, which is the footprint of the current A737 and the footprint of the scheme with a 10m buffer. Details of the construction methods and techniques (where available) are discussed in Chapter 3 'Construction, Operation and Maintenance'. The nearest waste management facilities to the scheme have also been described, although the sources of all materials cannot be definitively determined at this time.

Desk study and site walkover

11.2.2 The baseline conditions for materials and waste were established through a desk top review of publically available online information such as SEPA's Waste information website (Ref 11.4) and Google Maps (Ref 11.5). Further information on these and all

resources used in this chapter can be found within Chapter 19 References, Materials section. In addition, a site walkover was undertaken on 20 January 2016, which reviewed the existing conditions along the current A737, particularly to see any differences between OS maps and the actual conditions, and identify any features, eg road signs, which could be reused.

Consultation

11.2.3 Furthermore, consultation has been undertaken with SEPA. At the Stage 2 EIA SEPA noted that "All waste materials must be disposed of at a suitably licenced site". SEPA were again consulted during the preparation of the Environmental Statement and provided no further comments on materials or waste. Chapter 5 Consultation provides further information on the consultation carried out as part of the EIA.

Statutory and planning review

11.2.4 A desktop review of current legislation, planning policy and technical guidance was carried out to identify all relevant information to the project in relation to materials use and waste. The following websites and regulations were consulted during this review with further details provided within Table 11.7 and Chapter 19 References:

- www.north-ayrshire.gov.uk
- www.sepa.org.uk
- EU Council Directive 2006/12/FC (The Waste Management Directive)
- The Control of Pollution Act 1974 and amendment (1989)
- Environmental Protection Act (1990)
- Environmental Protection (Duty of Care) Regulations (1991)
- Special Waste Regulations (1996 as amended)
- The Environment Act (1995)
- The Waste (Scotland) Regulations (2012)
- Scottish Government 'National Planning Framework'
- Scottish Government 'Scottish Planning Policy'
- Scottish Government Zero Waste Plan (2010)
- Planning and Waste Management Advice Note (2015)

- North Ayrshire Local Development Plan (2014)

Assessment methodology

11.2.5 IAN 153/11 acknowledges that the assessment of impact of material use and waste generation is a developing area, and that the IAN is limited in its ability to address all the principles of environmental assessment, in particular in assessing significance. As a minimum, it is expected that an assessment should identify whether impacts are as positive or negative, permanent or temporary and direct or indirect. The following paragraphs describe the approach taken to assessing the impacts of materials use and waste generation for the scheme.

11.2.6 During Stage 2, a simple assessment was undertaken on the materials and waste requirements of the options for the scheme, in which readily available data and information was assembled to give better understanding of the likely environmental effects of the scheme. A detailed assessment is applied where the extent of the use and consumption of materials and the production and management of waste can be quantified and is undertaken in this chapter. The detailed assessment identifies and, wherever possible, quantifies the following:

- The types and quantities of materials required for the project
- The earthworks (cut and fill) balance
- The types and quantities of likely waste arisings from the project, including the identification of any likely hazardous wastes, for example, contaminated soils
- The impacts that will arise from the issues identified in relation to materials and waste
- A conclusion about the magnitude and nature of the impacts
- The identification of measures to mitigate the identified impacts.

11.2.7 In accordance with IAN 153/11, the assessment should identify receptors that may be impacted for materials and waste resources. These are likely to be:

- Material use receptors: Quarries and other sources of minerals and other finite raw material resources; specific sources of raw materials to be used for this scheme have not yet been identified; Soils and other geological material in the surrounding area (more information on soil resources can be found within Chapter 10 Geology and Soils); and the global climate, through the use of energy and resultant greenhouse gas emissions (for more information see Chapter 6 Air Quality).

- Waste management receptors: Waste treatment and recycling facilities, inert, non-hazardous and hazardous landfill sites.

11.2.8 The assessment of impact from material use and waste generation was undertaken using the following methodologies, based on a desk top search of readily available information along with discussions with the design engineer.

Material use assessment methodology

11.2.9 The assessment of impact from material use does not follow the standard environmental assessment method of combining sensitivity and magnitude to determine significance. The source of materials is not currently known and therefore the magnitude of impact cannot be assessed. Similarly, the sensitivity of the materials source also cannot be clearly defined.

11.2.10 However, if the source of material is from a recycled source, close to the scheme, then the impact it is considered to have a lesser impact than if the source was from a virgin supply. For example, reusing site won excavated materials from other areas of the site will have a lessor impact than those imported from off site; and materials sourced from sustainable or recycled sources will also have a lessor impact than those from virgin sources. These principles were applied to reach a conclusion as to whether the impacts from materials use are temporary or permanent, positive or negative and indirect or direct. As set out in IAN 135/11, permanent impacts are considered to be significant.

Waste generation assessment methodology

11.2.11 There are no accepted criteria for determining the sensitivity of waste resources including waste infrastructure. In the absence of such guidance, the waste assessment has been undertaken using professional judgement. Descriptions for the waste receptor sensitives and magnitude of impact are shown in Tables 11.1 and 11.2.

Table 11:1: Waste receptor sensitivity

Sensitivity	Description
High	There is no available waste management capacity for any waste arising from the project
Medium	There is limited waste management capacity in relation to the forecast waste arising from the project
Low	There is adequate waste management capacity for the majority of wastes arising from the project

Sensitivity	Description
Negligible	There is adequate available waste management capacity for all wastes arising from the project

Table 11:2: Waste magnitude of impact

Magnitude	Description
Major	Wastes are predominantly disposed of to landfill or to incineration without energy recovery with little or no prior segregation
Moderate	Wastes are predominantly disposed of to incineration with energy recovery
Minor	Wastes are predominantly segregated and sent for composting, recycling or for further segregation and sorting at a materials recovery facility.
Negligible	Wastes are predominantly re-used on site or at an appropriately licensed or registered materials reclamation centre

11.2.12 The significance of impact for waste generation is then determined using Table 4.3: Significance matrix from Chapter 4 Methodology.

11.3 Baseline conditions

Ground conditions and current material use

11.3.1 Information from Chapter 10 Geology and Soils indicates that ground conditions encountered from previous ground investigations comprised predominantly weathered glacial till overlain by fresh glacial till however there are areas of peat, organic silt and alluvial deposits as well as Made Ground deposits. Further details of ground conditions are included in 'Chapter 10 Geology and Soils'.

11.3.2 Road cores indicate that the road is of a typical structure with a hardcore sub-base and bituminous surface (asphalt and/or coal tar). The landscape to the east of the route is predominantly farmland with the adjoining roads likely constructed in a similar fashion to the A737. There are footpaths adjacent to both carriageways of Wardrop Street and adjacent to the northern carriageway of Barrmill Road. It is expected that the adjacent footpaths will be of the same construction as the roads.

11.3.3 There is a concrete footprint from a demolished electrical sub-station adjacent to Geilsland Road / A737 junction and residential garages adjacent to Barrmill Road / A737

junction. The concrete footprint of an old Scout Hall lies east of the Wardrop Street / A737 junction, south of Wardrop Street with an area of asphalt to the north, likely a parking area. These concrete footprints are likely to retain some services, eg drains (may be infilled), water or electrical / telecommunication connections.

11.3.4 The current A737 is a single carriageway road with the Department of Transport road traffic counter south west of the scheme showing the annual average daily traffic flows to be 9,233 vehicles including 331 heavy goods vehicles. An assessment of the impact on air quality from additional haulage vehicles has been undertaken in Chapter 6 'Air Quality'.

11.3.5 For further information on groundwater bodies and aquifers with sensitivity and impacts on hydrogeology and the water environment refer to 'Chapter 15 Road drainage and the water environment'.

Waste management infrastructure

11.3.6 Materials that cannot be reused within the construction of the scheme or another project are termed waste. The disposal of waste is assessed in terms of where and how they can be disposed and the associated impact of this disposal. Materials which may be classified as waste include the following:

- Excavated arisings, construction and demolition materials not suitable for reuse
- Excavated material classified as hazardous waste due to the presence of contaminants or invasive plant species
- Petrol runoff and sediments collected by interceptors
- Waste products arising from the presence of construction staff on site eg effluent from portable toilets, food waste and packaging
- Waste from surplus materials and spillages.

11.3.7 Table 11.5 provides an estimate of the likely waste types and quantities for this project.

11.3.8 A review of SEPA's website has indicated the nearest active landfill sites to the scheme, as summarised in Table 11.3.

Table 11.3: Waste management infrastructure

Name of site	Distance	Type of site	2013 Available capacity / Total capacity
Knowes Farm IV Landfill Site (PPC/W/0020008, NS 34250 55510)	2km northwest	Non-hazardous landfill site	43,130 / 750,000
Shewalton Landfill 2 (PPC/W/0020014, NS 32901 36800)	17km southwest	Non-hazardous landfill site	65,657 / 850,000
Avondale Landfill Site (PPC/E/0020086, NS 95274 78708)	65km northeast	Hazardous landfill site	24,439 / 800,000

11.3.9 The impact from spillages, surface water runoffs and material from interceptors are assessed within Chapter 15 'Road Drainage and the Water Environment'.

11.4 Detailed assessment

11.4.1 Details of the proposed construction activities can be found within Chapters 2 The project and alternatives considered and Chapter 3 Construction, operation and maintenance.

11.4.2 The preliminary cutting depths and embankment heights range from 2.84m below existing road profiles to 5.51m above existing road profiles. However, it is not currently known to what depth foundations for the footbridge will be but it is likely that they will be sited on bedrock. The earthwork requirements of the scheme have been assembled from the design engineers in Table 11.4. Overall there will be more excavation than fill required and therefore there should be no requirement to import fill material from outside the scheme. There will likely be approximately 2,508m^3 of excess acceptable material.

Table 11.4: Estimated Earthwork Quantities

Type of Earthworks	**Volume (m^3)**
Total excavation required	62,467 including 53,932 from cutting excavation
Total acceptable excavation available to be reused on site	32,359
Total unacceptable excavation*	30,108
Total fill required	29,851
Landscape fill (from unacceptable excavated material)	8,300
Imported fill	-2,508 indicating no import of fill required.
* The design engineers have assumed that the upper 2m of excavated material is unsuitable for reuse. This applies over the entire earthworks footprint from Geilsland Road northwards. From Geilsland Road southwards, the upper 1m would be unsuitable but the rest would be re-usable as-dug or with lime modification. In addition, from excavated material deeper than 1 and 2m, it has been assumed that 60% will be suitable for reuse.	

11.4.3 A summary of the impacts of the scheme, the materials likely to be required with projected quantities and the kinds of waste likely to be produced for the scheme are shown in Table 11.5 Detailed Assessment. All impacts associated with materials use and waste generation are assessed as being direct.

Table 11.5: Detailed Assessment for Materials Use and Waste Generation

Project activity	**Potential impacts associated with material resources / waste arisings**	**Description of the impacts**	
		Materials use	**Waste**
Site remediation / preparation			
Little or no remediation is anticipated at this stage, particularly as the current A737 will remain open during the majority of the works. There may be some diversion works for Scottish Gas, Scottish Water, Scottish Power and British Telecom Apparatus	Detailed design will provide further information on the materials required preparation. However, it is expected that the diversion works will use materials e.g. new cables or piping, aggregate backfill etc	Permanent, negative, direct	Adverse, permanent impact with minor magnitude
Site preparation likely to include the removal of vegetation within the proposed construction areas and general site clearance	Vegetation removed and general site clearance may be regarded as waste. It is expected that there will be a surface scrape of topsoil and sub soils to a depth of approximately 0.1m depth.	No impact	Adverse, permanent impact with minor magnitude
Site clearance for main site compound and offices – the location of the site compound has not yet been agreed; however, there will likely be hardstanding and infrastructure installation of contractor site offices which will require electricity,(connection to the grid / generator), telecommunications and to mains water supply / sewage system	Post construction, it is likely that all compound areas would be reinstated after construction; however this would be dependent on the compound location and the contractor.	Temporary, negative direct	Adverse, temporary impact with negligible magnitude

Project activity	**Potential impacts associated with material resources / waste arisings**	**Description of the impacts**	
		Materials use	**Waste**
Use of heavy plant and machinery – likely to be conventional two back-acters, two bulldozers (D5 size) and nine articulated dump trucks (Moxys)	There may be materials wastage through overuse or poor maintenance of plant and machinery, e.g. fuel, mineral oils, wear and tear on machinery, reduced lifespan of equipment.	Permanent, negative, direct and indirect	Adverse, permanent impact with minor magnitude
Demolition			
There would be no planned demolition of buildings or infrastructure. It is currently proposed that a 3m stretch of the existing A737 will remain for NMU use with the remainder being broken up and removed. Any existing utilities (Scottish Gas, Scottish Water, Scottish Power and British Telecom Apparatus), culverts and road infrastructure will require redirection.	Significant quantities of demolition waste, to be taken off site and sent to landfill. The quantities are unknown at present; however is proposed to be approximately 3000m^2 of existing road (to include 1400m^2 of planing (50mm depth) and 840m^2 of planing (100mm depth)). Waste materials are likely to include: • Asphalt • Aggregates • Metal • Concrete	Permanent, negative, direct	Moderate permanent adverse impact if waste materials are sent to landfill Minor permanent / temporary if most are recycled

Project activity	**Potential impacts associated with material resources / waste arisings**	**Description of the impacts**	
		Materials use	**Waste**
Site construction			
Use of excavated soils and rocks from cuttings and soil stripping as fill material for embankments and landscaped areas. The preliminary earthworks balance requires • 62,467m^3 of excavated material including 53,932m^3 from excavated cuttings • 29,851m^3 of fill material required. However, the design engineers have assumed that the upper 2m of excavated material would be unsuitable for reuse. This applies over the entire earthworks footprint from Geilsland Road northwards. From Geilsland Road southwards, the upper 1m would be unsuitable but the rest would be re-usable as-dug or with lime modification. In addition, from excavated material deeper than 1 and 2m, it has been assumed that only 60% will be suitable for reuse which would give the following. • 32,359m^3 total acceptable excavation	The volume of material that would be required as fill and as waste represent the most substantial use of resources and waste attributed to the scheme. Any materials classified during construction as unacceptable through geotechnical profiling or as excess material not required on site would likely be taken to a materials reclamation site Any materials deemed as special waste would need to be removed as waste to a hazardous landfill site, for example, contaminated soils (eg material with geochemical concentrations greater than the reuse criteria or seeds / rhizomes of invasive plant species).	Permanent, negative, direct	Minor permanent adverse impact for materials use Minor permanent adverse impact where waste is removed to a landfill site Minor temporary beneficial impact if waste can be reused or

Project activity	**Potential impacts associated with material resources / waste arisings**	**Description of the impacts**	
		Materials use	**Waste**
• 30,108m^3 total unacceptable excavation • 8,300m^3 landscape fill (from unacceptable excavated material) • -2,508m^3 of material to be imported indicating no import of fill required • 21,808m^3 exported as either excess materials or unacceptable materials for reuse. Use of materials for construction (SuDS basins) – the SuDS basins will require liners, filter bed material and aquatic plants. Earthworks volumes are included in the earthworks calculation above.			recycled
Use of materials for construction – Transportation	The transport of raw materials from a source across great distances to the construction site presents an avenue through which significant avoidable wastage could be attributed to the scheme. The source of construction materials is not yet known and would depend on the contractor; however suppliers are likely to be UK based	Permanent, negative, direct	Permanent, minor adverse

Project activity	**Potential impacts associated with material resources / waste arisings**	**Description of the impacts**	
		Materials use	**Waste**
	e.g. aggregates would be obtained from reputable suppliers, eg Aggregate Industries or Tarmac who own quarries throughout Scotland and the UK.		
Use of materials for construction of roads – Preliminary estimates indicate the following: • 7,704m^3 of sub-base • 34,239m^2 of bituminous base • 34,239m^2 of bituminous binder course • 34,239m^2 of bituminous surface course • 500 tonnes of bituminous regulating course • 102,717m^2 of tack coat	The import of aggregates and bituminous material will have impacts on material resources. Given the large quantities of materials required, the scheme will require a significant amount of materials in order to construct and maintain, most obvious of which is the materials used to construct the new road. Such materials are susceptible to wastage through spillage and surplus.	Permanent, negative, direct	Permanent, minor adverse
Use of materials for construction of drainage – Preliminary estimates indicate the following: • 2,989m of 150mm filter drain • 1,697m of 225mm filter drain • 1,828m of 300mm filter drain • 275m of 300mm road crossing	The use of concrete materials for drains represents substantial impact on resources. Some materials may come from recycled sources eg aggregate bedding materials, drainage covers; however the exact quantities are not yet known and would	Permanent, negative, direct	Permanent, minor adverse

Project activity	**Potential impacts associated with material resources / waste arisings**	**Description of the impacts**	
		Materials use	**Waste**
• 156 chambers • 162m of 450mm carrier • 20m of 750mm outfall carrier/ main culverts • 12 small headwalls • 50 gully chamber	depend on conditions on site. However, through the use of certified material eg by the Cement Sustainability Initiative or the Forestry Commission, as coming from recycled or sustainable sources, the impacts can be reduced.		
Use of materials for construction of footbridge – preliminary estimates are not yet available; however materials used are likely to include: • asphalt • aggregates • metal • concrete	There are likely to be large quantities of materials required. The bridge will be Bow Warren Truss design with curved upper and lower chords and a total span of 39m. The superstructure is formed with hollow section members and a steel deck plate. A clear width of 3.5m between 1.8m parapets is provided along the entire length of the structure. The deck will be supported off concrete bank seat abutments provided on either end of the footbridge. The structure will have a design life of 120 years and will be designed to tie in with the access path	Permanent, negative, direct	Permanent, minor adverse impact

Project activity	**Potential impacts associated with material resources / waste arisings**	**Description of the impacts**	
		Materials use	**Waste**
	levels on either side of the road.		
Use of materials for construction of street furniture – • 450m^2 take up and reuse drystone walling 1.0m in height • 6515m of woven wire fencing • 200m of screen fence • 25 field gates • 500m performance safety barrier • 16 performance terminals • 14 signs - small • 17 signs - large • 71 steel road lighting columns	Existing street furniture will be retained and reused where possible; however, it is inevitable that new items will be required	Permanent, negative, direct	Adverse minor permanent
Import of kerbs for footpaths – • 1930m of kerbs • 2495m of edging kerbs • 50 quadrants • 1686m of kerb drainage system • 6925m^2 of flexible footway paved area • 121m^2 of tactile paving area	Import of precast concrete kerbs would be required	Permanent, negative, direct	Permanent, minor adverse impact

Project activity	**Potential impacts associated with material resources / waste arisings**	**Description of the impacts**	
		Materials use	**Waste**
Operation and Maintenance			
The material resources and waste post construction cannot be estimated as the requirements will be subject to change over the life of a road. However assumptions can be made in that any road repairs will require granular sub base, rolled asphalt binder (60mm thick), rolled asphalt surface course and will have road planings as waste. However, if the road planings are suitable, they may be recycled at a materials reclamation centre.			

11.4.4 Where adverse permanent and temporary impacts are identified in Table 11.5, mitigation measures are employed to mitigate the impacts as shown in Table 11.6 along with a brief description of the measures (including where known the scale of the mitigation) and a description of how the mitigation measures would be implemented, measured and monitored and the resultant residual impact.

Table 11.6: Mitigation Measures and Residual Impacts

Project activity	**Potential impacts associated with material resources / waste arisings**	**Mitigation measures**	**How the measures will be implemented, measured and monitored**	**Residual Impacts**	
				Materials	**Waste**
Site remediation / preparation					
Little or no remediation is anticipated at this stage, particularly as the current A737 will remain open during the majority of the works. There may be some diversion works to Scottish Gas, Scottish Water, Scottish Power and British Telecom Apparatus	Detailed design will provide further information on the materials required preparation.	The scheme will attempt to re-use and recycle as much material as possible from the site and source recycled materials from off site. Discussions shall be undertaken by the contractor with SEPA regarding storage requirements and registration of any exemptions required. This is further assessed in	Measures will checked through the Materials Management Plan (MMP) which will be regularly reviewed.	Permanent, negative, direct	Through the use of the MMP, the impact can be reduced, however will still be adverse, minor and permanent

Project activity	**Potential impacts associated with material resources / waste arisings**	**Mitigation measures**	**How the measures will be implemented, measured and monitored**	**Residual Impacts**	
				Materials	**Waste**
		Chapter 14 Community and Private assets.			
Site preparation likely to include the removal of vegetation within the proposed construction areas and general site clearance	Vegetation removed and general site clearance may be regarded as waste. It is expected that there will be a surface scrape of topsoil and sub soils to a depth of approximately 0.1m depth.	Vegetation waste can be chipped and mulched on site and used as compost to help establish new planting. Scraped soil material will be stockpiled for reuse wherever possible (ie where materials are not contaminated) as part of a Soil Resource Plan (SRP) which forms part of a Materials Management Plan (MMP) developed to maximise use of existing resources and reduce	Regular review of MMP and Soil Resource Plan (SRP).	No impact	Through the use of the SRP and with most vegetation being reused on site, the impact will adverse, temporary and minor

Project activity	Potential impacts associated with material resources / waste arisings	Mitigation measures	How the measures will be implemented, measured and monitored	Residual Impacts	
				Materials	Waste
		waste. Discussions shall be undertaken by the contractor with SEPA regarding storage requirements and registration of any exemptions required.			
Site clearance for main site compound and offices – the location for the site compound has not yet been agreed; however, there will likely be hardstanding and infrastructure installation of contractor site offices which will require electricity,(connection to	Main compound areas would be reinstated after construction.	It is likely the site offices would be hired and renewable energy sources, mobile telecommunications and rain water harvesting should be considered for use as utilities. Any surplus material produced by construction should be either returned to the supplier or put into	The contractor will have final decision on site compound; however, the Site Waste Management Plan (SWMP) will detail waste source and final destination and will ensure that waste volumes are minimised.	Permanent, negative, direct	The use of the SWMP the impact will be reduced; however will remain adverse, temporary and negligible

Project activity	Potential impacts associated with material resources / waste arisings	Mitigation measures	How the measures will be implemented, measured and monitored	Residual Impacts	
				Materials	Waste
the grid / generator), telecommunications and to mains water supply / sewage system		segregated waste streams for recycling. All general waste produced by the site compound and offices should also be put into segregated waste streams for recycling. Discussions shall be undertaken by the contractor with SEPA regarding storage requirements and registration of any exemptions required.			
Use of heavy plant and machinery – likely to be conventional two back-acters, two bulldozers	There may be materials wastage through overuse or poor maintenance of plant	Ensuring plant and machinery are in good working order and are well maintained will reduce this	Contract requirements will ensure Contractor will maintain maintenance records	Permanent, negative, direct	Good maintenance and best practice will

Project activity	Potential impacts associated with material resources / waste arisings	Mitigation measures	How the measures will be implemented, measured and monitored	Residual Impacts	
				Materials	Waste
(D5 size) and nine articulated dump trucks (Moxys)	and machinery.	wastage, as will limiting the use of plant, machinery and vehicles in general to only necessary usage.	and will uphold good practice		reduce the impact to negligible.
Demolition					
There would be no planned demolition of buildings or infrastructure. It is currently proposed that a 3m stretch of existing road will remain for NMU use with the remainder being broken up and removed. Any existing utilities (Scottish Gas, Scottish Water,	Significant quantities of demolition waste, to be taken off site and sent to landfill.	Waste materials will be reused or recycled wherever possible; however there is potential for asbestos from utilities or coal tar from road surfaces which would have to be disposed of as special waste. A SWMP should be developed to maximise use of existing resources and	Waste contractor license and waste transfer notes. The SWMP and MMP will be used to ensure waste is minimised. They will be live documents which will regularly be reviewed and updated.	Permanent, negative, direct	The use of the SWMP and MMP will ensure that most material that will not be reused on site, will be recycled, reducing the impact to

Project activity	Potential impacts associated with material resources / waste arisings	Mitigation measures	How the measures will be implemented, measured and monitored	Residual Impacts	
				Materials	Waste
Scottish Power and British Telecom Apparatus), culverts and road infrastructure will require redirection.		reduce waste. Discussions shall be undertaken by the contractor with SEPA regarding storage requirements and registration of any exemptions required. In addition, best practice guidance within the SEPA Regulatory guidance – Promoting the sustainable reuse of greenfield soils in construction (Ref 11.6) PPG6 'Working at construction and demolition sites' (Ref 11.7) and Guidance on the			adverse minor and temporary.

Project activity	Potential impacts associated with material resources / waste arisings	Mitigation measures	How the measures will be implemented, measured and monitored	Residual Impacts	
				Materials	Waste
		Production of Fully Recovered Asphalt Road Planings (Ref 11.8) will be employed to reduce the impacts.			
Site construction					
Use of excavated soils and rocks from cuttings and soil stripping as fill material for embankments and landscaped areas. Use of materials for construction (SuDS basins) – the SuDS basins are likely to require clay liners	The volume of material that would be required as fill and as waste represent the most substantial use of resources and waste attributed to the scheme. Any contaminated soils (eg contaminated by heavy metals, hydrocarbons or seeds / rhizomes of	A MMP will maximise the reuse of soils within the scheme. Wherever possible, any fill material imported onto site should come from a reclaimed source to reduce the use of virgin materials and any excavated materials should be reused wherever possible. This will reduce the impacts	Regular monitoring of earthworks movements and regular geochemical analysis to ensure integrity. In addition, the MMP will be a live document which will regularly be reviewed and updated.	Permanent, negative, direct	The use of the SWMP and MMP will ensure that most material that will not be reused on site, will be recycled, reducing the impact to

Project activity	Potential impacts associated with material resources / waste arisings	Mitigation measures	How the measures will be implemented, measured and monitored	Residual Impacts	
				Materials	Waste
(dependant on reuse potential of material on site), filter bed material and aquatic plants.	invasive plant species) would need to be removed as waste to a hazardous landfill site.	from adverse to beneficial. Discussions shall be undertaken by the contractor with SEPA regarding storage requirements and registration of any exemptions required.			adverse / beneficial, minor and temporary.
Use of materials for construction – transportation	The transport of raw materials from a source across great distances to the construction site presents an avenue through which significant avoidable wastage could be attributed to the scheme. The source of	Using locally sourced materials and by ordering materials as and when required, a reduction in the amount of excess materials wastage may be achieved with the associated reduction of transport costs and carbon footprint.	Contractor will decide on source of construction materials; however best practice and the MMP will ensure minimal wastage.	As the source of materials is not yet known, the impact must remain permanent, negative and direct	As the source of materials is not yet known, the impact will remain the same - adverse, minor

Project activity	Potential impacts associated with material resources / waste arisings	Mitigation measures	How the measures will be implemented, measured and monitored	Residual Impacts	
				Materials	**Waste**
	construction materials is not yet known.				permanent
Use of materials for construction of roads	The import of aggregates and bituminous material will have impacts on material resources. Given the large quantities of materials required, the scheme will require a significant amount of materials in order to construct and maintain, most obvious of which is the materials used to construct the new road. Such materials	Wherever possible, materials and aggregates should come from a reclaimed source to reduce the use of virgin materials. Discussions shall be undertaken with SEPA regarding registration of any exemptions required.	Contractor will decide on source of construction materials. The use of voluntary standards such as CEEQUAL, Waste & Resources Action Programme (WRAP), Institution of Civil Engineers (ICE) Demolition Protocol, Building Research Establishment Environmental Assessment Methodology and the	Permanent, negative, direct	Through the use of best practice, a SRP and MMP, the impacts can be reduced from minor to negligible; however, at this stage, the source is not known and so must remain

Project activity	**Potential impacts associated with material resources / waste arisings**	**Mitigation measures**	**How the measures will be implemented, measured and monitored**	**Residual Impacts**	
				Materials	**Waste**
	are susceptible to wastage through spillage and surplus.		UK Green Building Council will ensure materials will be sourced from the best available sources not entailing excessive cost. This will be reinforced through the use of the SWMP and MMP.		minor.
Use of materials for construction - drainage	The use of concrete materials for drains represents a substantial impact on resources. Some materials may come from recycled sources eg bedding materials, drainage covers	Recycled and reused materials should be used wherever possible as part of the MMP and SWMP.		Permanent, negative, direct	
Use of materials for construction - footbridge	There are likely to be large quantities of materials required.	Where possible, materials should come from a reclaimed source to reduce the use of virgin materials.		Permanent, negative, direct	
Use of materials for construction - street	Existing street furniture will be retained and	Where possible, materials should come from a		Permanent, negative,	

Project activity	**Potential impacts associated with material resources / waste arisings**	**Mitigation measures**	**How the measures will be implemented, measured and monitored**	**Residual Impacts**	
				Materials	**Waste**
furniture	reused where possible; however, it is inevitable that new items will be required	reclaimed source to reduce the use of virgin materials. Inefficient lighting solutions could cause continuous wastage of energy; efficient lighting solutions be considered, including LEDs, in conjunction with sustainable sources of energy to power any lighting required.		direct	
Import of kerbs for footpaths.	Import of precast concrete kerbs will have a permanent, moderate adverse effect on material resources.	Where possible, materials should come from a reclaimed source to reduce the use of virgin materials.		Permanent, negative, direct	

11.5 Statutory and legislative impacts

11.5.1 The scheme has been assessed for impacts against statutory legislation and planning policies based on the findings of Table 11.5 as shown in Table 11.7.

Table 11.7: Statutory and planning context

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
EU Council Directive 2006/12/FC (The Waste Management Directive)	Sets out aims of waste management and disposal for EU members so that waste is not disposed of in a manner that would impact on human health or the environment and encourages waste reduction, recycling and reuse.	The production of a SWMP, MMP and SRP will reduce the amount of waste produced by the scheme.	Yes through the use of SWMP, MMP and SRS, waste from this scheme will be recycled and reused wherever possible and the scheme will comply with the objectives of this directive.
The Control of Pollution Act 1974 and (Amendment) 1989	An act of parliament put forward with the purpose of governing the disposal of waste and to regulate and control water, noise and atmospheric pollution; amended in 1989 in order to provide further governance specific to the disposal of waste materials.	The production of a SWMP, MMP and SRP will reduce the amount of waste produced by the scheme.	Yes through the use of SWMP, MMP and SRS, waste from this scheme will be recycled and reused wherever possible the scheme will comply with the objectives of this act.
Environmental Protection Act	An act of parliament put forward in order to make provision for the improved control of pollution arising from	The production of a SWMP, MMP and SRP	Yes through the use of SWMP, MMP and SRS, and

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
1990	certain industrial or other processes. In relation to waste and materials, this act was put forward to re-enact the provisions of the above legislation (The Control of Pollution Act 1974) regarding waste.	will reduce the amount of waste produced by the scheme.	best practice techniques, the waste from this scheme will be minimised and so the scheme will comply with the objectives of this act.
Environmental Protection (Duty of Care) Regulations 1991	These regulations impose a duty of care on any person who imports, produces, carries, treats or disposes of controlled waste to ensure there is no unauthorised or harmful depositing, treatment or disposal of waste. These were amended but not superseded by the Environmental Protection (Duty of Care) Regulations 2003 (SI 63), which allow waste collection authorities to serve notices on people required to keep written descriptions of waste and transfer notes, and to require them to produce such documents to the authority within a specified time.	All waste reused on site will be done under a Section 13 Waste Exemption Certificate. All Waste removed from site, will be removed by a licensed waste contractor with fully completed waste transfer notes	Yes, all waste produced by the scheme will reused or removed from the site in accordance with these regulations and the scheme will comply its objectives.
Special Waste Regulations 1996 as amended	The purpose of the legislation is to control the movements of the most hazardous types of waste. The law refers in particular to a list of waste materials that are listed in the schedule of the act. The regulations are the principal piece of legislation covering special waste arising in Scotland.	All special waste removed from site will be removed by a licensed waste contractor with fully	Yes, by delineating any areas of contaminated land and by complying with all regulations, the scheme will comply with its objectives

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
		completed waste transfer notes.	
The Environment Act 1995	An act of parliament enacted to set up the Environment Agency, the Welsh Environment Agency and the Scottish Environment Protection Agency. It also required the preparation of a national air quality strategy, provided for the establishment of air quality management areas; the preparation of a national waste strategy, with power to impose obligations on producers; improved the current protection of hedgerows; introduced new provisions in the Environmental Protection Act 1990 dealing with contaminated land and abandoned mines and formalised the Sandford Principle which concerns the management of protected landscapes and included the conservation of environment and access for the public.	The production of a SWMP, MMP and SRP will reduce the amount of waste produced by the scheme.	Yes, the use of the SWMP, MMP and SRP will reduce the amount of waste and so reduce the impact and requirements of the scheme, particularly how the scheme deals with any areas of contaminated land the scheme will comply with the objectives of this act.
The Waste (Scotland) Regulations 2012	Sets out requirements for businesses to segregate materials such as glass, metal, plastics, paper and card for recycling	The production of a SWMP, and MMP will specify all waste streams to be segregated	Yes, through the use of the SWMP and the MMP, the objectives of these regulations will be fulfilled.

Legislation / Plan / Policy	**Description**	**Relevance to scheme**	**Achieves objectives? (Y/N)**
National Planning Framework	The Scottish Government sets out the context for development planning in Scotland and provides a framework for the spatial development of Scotland as a whole with a focus on supporting sustainable economic growth and the transition to a low carbon economy; and a goal of 70% of waste to be recycled by 2020.	The production of a SWMP, MMP and SRP will reduce the amount of waste produced by the scheme.	Yes the scheme aims to minimise the amount of waste produced and sent to landfill. In addition, through the use of quality schemes such as CEEQUAL, the scheme aims to have a focus on sustainability.
Scottish Planning Policy	Sets out national planning policies which reflect Scottish Ministers' priorities for operation of the planning system and for the development and use of land and aims to promote developments that minimise the unnecessary use of primary materials and promote efficient use of secondary materials	The production of a SWMP, MMP and SRP will reduce the amount of waste produced by the scheme.	Yes through the reuse of excavated material on site, the scheme aims to reduce as much as possible the need for primary or virgin materials.
Scottish Government Zero Waste Plan 2010	Sets out a vision of a zero waste Scotland where waste is treated as a valuable resource and proposes a long term target of recycling 70% of Scotland's waste	The production of a SWMP, MMP and SRP will reduce the amount of waste produced by the scheme.	Yes, through reusing as much material as possible, segregating waste streams and using sustainable and recycled sources of

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
			materials, the scheme will comply with the objectives of this plan.
Planning and Waste Management Advice July 2015	This replaced Planning Advice Note (PAN) 63 on Waste Management Planning and complements the National Planning Framework, Scottish Planning Policy and Scotland's Zero Waste Plan. It promotes a low carbon place and 'circular economy' which means re-using products and materials.	The production of a SWMP, MMP and SRP will reduce the amount of waste produced by the scheme.	Yes, by sourcing materials from recycled sources wherever possible and by reusing and recycling excavated materials, the scheme will comply with the objectives of this advice note
North Ayrshire Local Development Plan (2014)	Policy PI 7 Waste Management - Sets out criteria which determine where facilities for waste processing, recovery and disposal would accord with Waste Management policy	The production of a SWMP, MMP and SRP will reduce the amount of waste produced by the scheme.	Yes, the SWMP and MMP will reuse materials wherever possible and if they cannot be reused, will be taken to a material reclamation site for processing, fulfilling the objectives of this plan.

11.6 Limitations

11.6.1 As the detailed construction design plans have not yet been finalised, material use and waste quantities are preliminary at this stage. In addition, the sources of materials cannot be identified at this stage and the site compound location and pre-site preparation works that will be undertaken by the contractor also cannot be ascertained at this stage.

11.6.2 A proportion of the potential impacts associated with materials cannot be absolutely predicted, as they would only occur if something went wrong (ie they would be the result of unplanned, accidental occurrences, such as spillages, or as a result of failure by a contractor to follow procedures eg the SWMP, MMP or SRP).

11.7 Conclusion

11.7.1 As this is a new primarily offline road scheme, the materials impact is likely to be substantial; however by maximising the reuse of excavated materials through the use of SWMP and MMP, then this impact may be reduced by reducing the volume of virgin materials required by the scheme. The Contractor shall produce the SWMP and MMP as part of the Construction Environment Management Plan (CEMP), which shall also include methods of material procurement to ensure the most suitable materials with lowest impacts are used in the construction of this scheme eg the use of carbon management tools.

11.7.2 Although every effort will be made to ensure materials are sourced locally, logistical constraints will cause inevitable wastage through transport of materials. Similarly, it cannot be realistically expected that all materials will be suited to reuse or recycling options and will therefore be considered waste.

11.7.3 The scheme will result in the production of waste that will have to be taken off site and disposed to landfill or removed to a materials reclamation site. The main sources of waste will be soils that cannot be reused on site and organic waste from site clearance. Through the utilisation of the SWMP, a MMP and a SRP and through recycling of waste materials, the impact of waste generation will be reduced.

11.7.4 Although every effort will be made to reduce the impact of the scheme, the overall impact will be permanent, negative and direct for material use and moderately adverse for waste for materials disposed of at landfill and minor adverse for waste materials either reused on site or taken to a materials reclamation centre.

12 Noise and Vibration

12.1 Introduction

12.1.1 This chapter details the predicted noise and vibration impacts of the proposed improvements to the A737 trunk road at Beith and describes the measures that have been proposed to avoid or reduce the potential impacts of the scheme.

12.1.2 The assessment considers the impacts arising from road traffic noise during the operation of the scheme on sensitive receptors. Impacts on sensitive receptors during construction of the scheme are also considered. The Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3 Part 7 HD 213/11 – Revision 1 (Ref 12.1) paragraph A1.13 provides examples of sensitive receptors as dwellings, hospitals, schools, community facilities, designated areas and public rights of way. Designated areas are listed as:

- Area of Outstanding Natural Beauty (AONB)
- National Parks
- Special Area of Conservation (SAC)
- Site of Protection Area (SPA)
- Site of Special Scientific Interest (SSSI)
- Scheduled Ancient Monuments (SAM).

12.1.3 The assessment provides guidance on short and long term noise level changes that should be mitigated if possible.

12.2 Key issues

Noise

12.2.1 The term "sound" describes the acoustic conditions which people experience as part of their everyday lives. The assessment considers how those conditions may change through time and how sound levels and the acoustic character of the area would likely be modified by the scheme.

12.2.2 The term "noise" is defined as unwanted sounds which have adverse impacts and are termed noise impacts rather than sound impacts. Mitigation in the form of noise barriers (eg bunds or fences) is known as noise mitigation.

12.2.3 Road traffic noise is a source that with prolonged exposure will affect people in their homes both during the day and night. The index adopted by the UK Government to assess road traffic noise is $L_{A10,18h}$ which is the arithmetic mean of the noise levels exceeded for 10% of the time in each of the 18 one hour periods between 6:00am and midnight of a working day. The 'A' in the subscript denotes that the sound levels have been 'A' weighted. Weightings are proposed to convert measured sound pressure to a measure that correlates with the perceived loudness by humans in different circumstances. The 'A' weighting is the most common conversion and is used to establish the perceived loudness of road vehicles.

12.2.4 The Calculation of Road Traffic Noise (CRTN) (Ref 12.2) provides the standard for predicting the $L_{A10,18h}$ road traffic levels which are usually predicted at a point of 1m from the external façade of the building.

12.2.5 The equivalent continuous sound level, $L_{Aeq,T}$ which is the level of a continuous constant noise that would deliver the same sound energy over the period of measurement. This can describe short periods of noise as well as relative long quiet periods. $L_{Aeq,T}$ is typically used in describing noise impacts during construction activities.

12.2.6 The level of noise received at some distance from the source is affected by a number of factors relating firstly to the amount of noise generated and secondly to the amount by which it is attenuated as it travels through the air.

12.2.7 Changes in noise levels arise from various factors such as:

- Changes in road alignment
- Sound generation including traffic flow, speed, composition, road surface type
- Sound propagation including distance to sensitive receptors, ground topography, ground absorption, screening and reflection.

Night-time noise

12.2.8 The DMRB HD 213/11 requires an assessment of night-time traffic noise levels ($L_{night,outside}$), however this parameter is not predicted by CRTN methodology. Paragraph 3.26 of HD 213/11 describes using the Transport Research Laboratory (TRL) report "Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping" (Ref 12.3) which provides three methods that can be used to estimate the $L_{night,outside}$. The methods are as follows:

- Method 1 - uses individual 1 hour traffic data over the night-time (11.00pm -7am)

- Method 2 - uses the 8 hour average night-time
- Method 3 – estimates the $L_{night,outside}$ from the $L_{A10,18h}$ traffic noise level.

12.2.9 Method 3 was used to estimate the noise levels at night.

12.2.10 The World Health Organisation's (WHO) Night Noise Guidelines for Europe, 2009 (Ref 12.4) provides recommended guidelines to protect public health, including most vulnerable groups such as the elderly and children. Table 12.1 derives guideline values based on impacts on health. The night-time guideline is set for the recommended noise level that the population should not be exposed to at night in the long term. The $L_{night,outside}$ value of 40dB is considered as the health based limit of the Night Noise Guidelines. If this target is not feasible in the short term an interim target of 55dB $L_{night,outside}$ is recommended.

Table 12.1: WHO night-time noise guideline values

Target	$L_{night,outside}$ dB
Interim target (IT)	55
Night Noise Guideline (NNG)	40

Vibration

12.2.11 Road traffic vibration is a low frequency disturbance producing physical movement in buildings and their occupants. Vibration can happen during the operation of an existing or new road, during the improvement or maintenance of an existing road, and also during the construction of a new road. It can be transmitted through the air or through the ground.

12.2.12 Airborne vibration from traffic can be produced by the engines or exhausts of road vehicles with dominant frequencies in the 50-100 Hertz (Hz) range. Ground-borne vibration is more often in the 8-20 Hz range and is produced by the interaction between rolling wheels and the road surface.

12.2.13 Ground-borne vibration is usually measured in terms of peak particle velocity which is measured in terms of movement in mm/s. The DMRB HD 213/11 (Ref 12.1) paragraph 3.41 states that if the level of vibration at sensitive receptors is predicted to rise to above a level of 0.3mm/s or an existing level above 0.3mm/s is predicted to increase, then this would be classed as an adverse impact from vibration.

Scoping noise impact assessment

12.2.14 The DMRB HD 213/11 (Ref 12.1) recommends using a risk based approach for noise impact assessment with three assessment levels:

- Scoping
- Simple
- Detailed

12.2.15 The DMRB HD 213/11 states that "a change in road traffic noise of 1 dB $L_{A10,18h}$ in the short term (eg when a scheme is opened) is the smallest that is considered perceptible. In the long term (typically 15 years after project opening), a 3 dB $L_{A10,18h}$ change is considered perceptible. A change in noise levels of 1dB $L_{A10,18h}$ is equivalent to a 25% increase in traffic flow or a 20% decrease in traffic flow, assuming other factors remain unchanged. A change in noise levels of 3dB $L_{A10,18h}$ is equivalent to a 100% increase in traffic flow or a 50% decrease in traffic flow".

12.2.16 Short-term impacts are defined as noise level changes when the project is opened. Long-term impacts are defined as noise level changes typically 15 years after the project opening or the worst year within those years in terms of noise nuisance. Assessing nuisance generally takes road traffic as the dominant noise source. Therefore any year within the 15 year period after opening that is considered to have no future traffic growth is considered to be the worst year.

12.2.17 These degrees of change (ie 1 dB $L_{A10,18h}$ in the short term and 3 dB $L_{A10,18h}$ in the long term) are the threshold values to proceed to either a:

- Simple assessment (where it is not clear whether the threshold values will be met or exceeded at noise sensitive receptors)
- Detailed assessment (where conditions indicate that the threshold values are likely to be reached or exceeded).

12.2.18 If it is not clear whether the scheme will result in significant noise and vibration impact, the assessment initially proceeds to the simple assessment. However, where it is clearly evident that the project will result in significant noise and vibration impacts' it is appropriate to go straight to a detailed assessment.

12.2.19 The Stage 2 EIA assessed the noise change from the proposed route options and identified sensitive receptors where the threshold values for noise were exceeded. It was clear that the preferred footprint would result in a permanent change in noise levels

exceeding 1dB $L_{A10,18h}$ in the short-term or 3dB $L_{A10,18h}$ change in the long-term and accordingly a detailed noise impact assessment is carried out in this ES.

12.3 Methodology

Statutory and planning review

12.3.1 A desktop review of current legislation, planning policy and technical guidance was carried out between 16 November 2015 and 08 December 2015 to identify all relevant information to the project in relation to noise and vibration.

12.3.2 The following documents and information sources were reviewed:

- The Environmental Protection Act 1990 (as amended) (Ref 12.5)
- The Control of Pollution Act 1974 (Ref 12.6)
- The Environment Act 1995 (Ref 12.7)
- Noise and Statutory Nuisance Act 1993 (as amended) (Ref 12.8)
- Land Compensation (Scotland) Act 1973 (as amended)(Ref 12.9)
- Environmental Noise (Scotland) Regulations 2006 (Ref 12.10)
- Noise Insulation (Scotland) Regulations 1975 (Ref 12.11)
- Transport Scotland Note STO S069 (Old Road Directorate Office Instruction No2/92) (Ref 12.12)
- Planning Advice Note 1/2011 'Planning and Noise' (PAN 1/2011)(Ref 12.13)
- Technical Advice Note: Assessment of Noise (TAN 2011) (12.14)
- North Ayrshire Council Local Development Plan 2014 (Ref 12.15)
- North Ayrshire Draft Local Transport Strategy 2015-2020 (Ref 12.16)

Determination of baseline

Study area

12.3.3 The study area as defined in the DMRB HD 213/11 (Ref 12.1) usually includes an area of 1km from the carriageway edge of the scheme and any existing routes being bypassed or improved as well as an area of 600m around any route where there is the possibility of a change of 1dB $L_{A10,18h}$ or more in the short term or 3dB $L_{A10,18h}$ or more in the long term. However, traffic engineers have indicated that the extent of the traffic model would be in a smaller area than the one defined in the DMRB of roughly 1km

buffer. The S-Paramics traffic model extents were agreed with the Overseeing Organisation at the outset of DMRB Stage 2 Assessment. This is detailed within report 'DMRB Stage 2 and 3 Traffic Modelling and Economic Assessment Proposal', Amey, 28th May 2014. The local network within Beith town centre has not been included within the model as the options developed through the Strategic Transport Appraisal Guidance (STAG) aimed to minimise any impact on the local road network. The new A737 alignment is effectively moving further away from the existing A737 and the town of Beith which will result in a reduction of noise level for these properties within the town. This formed one of the five objectives used to guide STAG study. The model extents used in the Paramics modelling included all main routes to and from Beith town centre, allowing sufficient road length on the side roads to enable any queuing and journey time impacts to be measured. For this reason, the study area was defined as the area within 300m of the new road (the scheme) and the existing road being bypassed by the new scheme. In this case, this means that calculation area (ie the area object of a detailed quantitative assessment through the building and running of a noise model) coincides with the study area (ie the calculation area plus the additional area where a qualitative assessment is undertaken). Chapter 2 The Project and Alternatives provides details of the traffic model used in the assessment.

12.3.4 As set out in the DMRB, the study area to identify vibration impacts is all residential dwellings within 40m of the edge of the carriageway.

12.3.5 For the purposes of the assessment, due to the large number of receptors identified, representative receptors are chosen using professional judgement as those receptors that may experience noise changes that may result in most beneficial and adverse impacts. Representative receptors are illustrated within Figure 12.1: Noise study area and representative receptors. All receptors within the calculation area will be assessed in terms of change in noise levels and provided mitigation where required.

12.3.6 The DMRB HD 213/11 assessment of temporary impacts (Ref 12.1) Section A1.23 states that as a minimum the study area for assessing construction impacts should be the same as permanent impacts. Therefore the study area for assessing construction impacts is 300m either side the new A737 road.

Desk study

12.3.7 A desktop study was undertaken to identify any Candidate Noise Management Areas in Scotland, as required under the Environmental Noise Directive (Ref 12.17), and any designated sites. Sources used are:

- Strategic Noise Mapping in Scotland, (Ref 12.18)
- Multi Agency Geographic Information for the Countryside (MAGIC) interactive maps (Ref 12.19)
- Scottish Government - Second Round of Strategic mapping (Ref 12.20)
- Scottish Government - Transportation Noise Action Plan (Ref 12.21)
- Candidate Noise Management Areas (Ref 12.22)

Field study

12.3.8 Baseline noise surveys were undertaken in accordance with BS 7445: Description and measurement of environmental noise (Ref 12.23), CRTN (Ref 12.2) and STO S069 (Ref. 12.12) on the following dates to provide data on the existing ambient noise levels at a selection of receptors within the study area:

- 7 to 9 October 2014 – attended, short term
- 3 December 2015 – attended, short term

12.3.9 The data are used for rating the construction impacts and to ascertain that the acoustic character of the area is dominated by road traffic noise and therefore the road traffic model may be used to reproduce the existing scenario for the operational assessment.

12.3.10 The findings of the baseline noise survey are discussed in paragraphs 12.4.8 to 12.4.9 and 12.4.12 to 12.4.13.

Consultation

12.3.11 North Ayrshire Council (NAC), Environmental Health Department was consulted on 5 November 2014 during the Stage 2 EIA to identify any noise issues or particular constraints for the proposed study area. The scheme has developed and further consultation with NAC was undertaken on 24 December 2015 to identify detailed constraints within the study area in regards to noise.

12.3.12 Further details on consultation can be viewed within Chapter 5 Consultation, with written correspondence included in Appendix 5.1.

Assessment of temporary impact

Noise

12.3.13 Temporary impacts are those potential noise and vibration impacts from the scheme that occur during the construction of the project.

12.3.14 The assessment of temporary impacts usually compares the difference in the noise and vibration climate between a baseline year and a future assessment year. The baseline and future years for the assessment of temporary noise and vibration impacts (ie from construction activities) are as follows:

- The baseline year is that immediately prior to the start of construction works
- The future year is a year during the period of construction/maintenance works.

12.3.15 A detailed construction programme that identifies the schedule and duration of works and the equipment and plant used is not available at this stage, therefore in order to undertake a quantitative assessment for construction noise a generic assessment was undertaken in accordance with BS5228:2009+A1:2014 "Code of practice for noise and vibration control on construction and open site – Part 1 Noise and Part 2 Vibration" (Ref 12.24). This provides guidance for predicting construction noise and advice on noise and vibration mitigation techniques. Construction noise levels are measured as an equivalent continuous noise level averaged over a suitable assessment period, eg a 1 hour period ($L_{Aeq,1h}$).

12.3.16 The construction assessment includes:

- The identification of sensitive receptors as per the DMRB within the study area which could be affected by noise arising from the construction site
- Consideration of some specific elements like bridges, tunnels, needs for demolition, area of works, amounts of earth excavation and filling, etc. that could result in a longer construction time or larger construction noise impacts
- A noise model to be built using NoiseMap software to predict the L_{Aeq} noise levels with the generic construction activities and plant in place

12.3.17 Annex F of BS5228 sets out the calculation procedures and annexes C and D provide a generic noise levels database of various plant.

12.3.18 Within BS5228 (annex E.3.2) (Ref 12.24) this assessment uses the "ABC method" which is based on exceedance of fixed noise limits to determine if the noise threshold has the

potential to result in the impacts on dwellings to be significant. The ABC method was chosen as it is intended for dwellings, which are the majority of receptors within the scheme, it considers different thresholds for day, evening and night periods as well as for weekdays, Saturdays and Sundays and since it uses background noise levels rounded to the nearest 5 dB is more robust against little differences within the background noise levels than the "5 dB(A) change" method (the latter in BS 5228-1 annex E.3.3). Table 12.2 shows the noise thresholds and period of the day/evening/night. The values are used when ambient noise levels (when rounded to the nearest 5dB) are less than (Category A values), equal to (Category B values) or higher than (Category C values) the values in category A column.

Table 12.2: Threshold of potential significant impact at dwellings in dB $L_{Aeq,T}$

Period	Category A	Category B	Category C
Daytime weekday (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75
Evenings weekday (19:00-23:00), Saturdays (13:00-23:00) and Sundays (07:00-23:00)	55	60	65
Night-time (23:00-07:00)	45	50	55
Note: If the ambient noise level exceeds the Category C threshold values given in the table (ie the ambient noise level is higher than the above values), then a potential significant impact is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.			
Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.			

Long term substantial earth moving

12.3.19 Where construction activities involve large scale and long term earth moving activities, BS 5228-1 section E.5 suggests that a limit of 55 dB $L_{Aeq,1h}$ would be adopted for daytime

construction noise for these type of activities, where the works are likely to occur for a period in excess of six months.

Vibration

12.3.20 Vibration impacts during construction are largely related to blasting or piling activities, which are not expected to be required to construct the scheme. The Transport Research Laboratory (TRL) Report 429 (Ref 12.25) indicates that other highway construction activities within 50m from the plant have a vibration level less of than 0.2mm/s. The DMRB states that the peak particle velocity (PPV) levels of groundborne vibration are perceptible above the level of 0.3mm/s. Therefore vibration levels fall within imperceptible levels.

12.3.21 It is concluded that vibration impacts during construction can be scoped out of the assessment. If the contractor proposes piling methods near to properties then a construction vibration assessment will be required and will be carried out prior to works starting.

Mitigation

12.3.22 If noise levels are considered to be significant during construction, mitigation such as bunds, enclosures or barriers will be required if necessary and best practicable means from BS 5228 will be put in place.

12.3.23 When even after the application of best practicable means, construction noise may be disruptive, Regulation 5 of the Noise Insulation (Scotland) Regulations (NISR) provides relevant authorities with discretionary powers to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings with respect to construction noise.

12.3.24 Regulation 5 of the NISR provides no noise levels from which insulation might be granted. Rather, it states that insulation might be granted where construction noise is "at a level which, in the opinion of the appropriate highway authority, seriously affects or will seriously affect for a substantial period of time the enjoyment of an eligible building adjacent to the site on which the works are being or are to be carried out…".

12.3.25 In relation to Regulation 5, Transport Scotland note STO S069 (old Instruction 2/92) states (Ref 12.12):

"Where traffic noise is unlikely to affect the eligible buildings then the following arrangements should be applied.

1. Where continued occupation of an eligible building is made unreasonable by construction noise exceeding a L_{eq} of 75dB(A) for 12 hours one metre from the facade for a period of about a month, alternative temporary accommodation (i.e. in a hotel) should be offered if the cost of that accommodation is likely to be less than the cost of insulating the building.

2. If the noise associated with roadworks is likely to continue for more than 2 months (for a period less than this, alternative temporary accommodation is likely to meet the need more economically) and the construction noise levels are likely to be in excess of a L_{eq} of 70dB(A) for 12 hours one metre from the facade insulation should be provided.

3. Where nuisance (i.e. noise, vibration, mud, dust etc) is likely to be caused for 4 months or more with construction noise level in excess of a L_{eq} of 75dB(A) for 12 hours one metre from the facade, consideration should be given to the purchase and resale of the eligible building. (Lower noise levels might be more appropriate when night or lengthy week-end working is involved). If it were decided to purchase and resell a dwelling house, it would not be necessary, on reselling, to offer it first to other Government Departments, nationalised industries and local authorities.

12.3.26 The Department will consider cases where the owner/occupiers are particularly sensitive to and are affected by construction noise to a degree where it is either making an existing illness worse or is likely to cause illness.

12.3.27 Medical evidence would be required to support such cases."

12.3.28 To overcome the lack of specific criteria in the NISR and STO S069 for evening and night-time and for Saturdays and Sundays, this assessment has taken as a reference the proposal for a noise insulation scheme included in BS 5228-1 section E.4. That proposal includes further criteria for noise level thresholds (see Table 12.3 below).

12.3.29 In order to determine if the properties are eligible for noise mitigation Table 12.3 identifies trigger levels for certain time periods. These trigger levels should be exceeded for a period of one or two months depending on the circumstances under STO S069 or for a period of ten or more days of working in any fifteen consecutive days or for a total of days exceeding 40 in any 6 month period under BS 5228-1.

Table 12.3: Time periods, average times and noise levels associated with the determination of eligibility for noise insulation (STO S069 and BS 5228-1)

Time	Relevant time period	Averaging time, T, in hours	Noise insulation trigger level dB $L_{Aeq,T}^{(A)}$
Monday to Friday	07.00 – 19.00*	12 h*	70/75*
	19.00 – 22.00	3 h	65
	22.00 – 07.00	1 h	55
Saturday	07.00 – 08.00	1 h	70
	08.00 – 13.00	5 h	75
	13.00 – 14.00	1 h	70
	14.00 – 22.00	3 h	65
	22.00 – 07.00	1 h	55
Sunday and Public Holidays	07-00 – 21.00	1 h	65
	21.00 – 07.00	1 h	55
(A) All noise levels are predicted or measured at a point 1 m in front of the most exposed of any windows and doors in any façade of any eligible dwelling. * From STO S069 (See paragraphs 0 to 12.3.27 above)			

Assessment of operational impact

Noise and vibration assessment

Noise model

12.3.30 A noise model was built to provide a 3 dimensional (3D) model of features to give baseline noise levels and predict road traffic noise levels at each of the receptors within the study area with the scheme in place. These figures are then compared under the assessment scenarios to determine the change of noise levels on receptors of specific sensitivity to evaluate if the impacts of the scheme are significant or not significant. The following data sources are required:

- Ordnance Survey (OS) MasterMap®, 2014 Edition (Ref 12.26) data to define the existing roads and features such as the location of buildings. The features of the study area were determined through a site visit carried out on the 7 to 9 October 2014. The addresses of the study area were obtained from OS AddressBase.

- Amey carried out a 3D topographical survey which was used within the noise model to generate the topographic levels of the study area.
- 18 hour annual average weekday traffic flow (AAWT) for assessment scenarios
- Percentage of heavy goods vehicles (HGV)
- Annual average speed
- Road surface.

12.3.31 The noise model receptor heights are assumed to be 1.5m for ground floor levels and a 4m height assumed for all two-storey or tall buildings.

12.3.32 For the prediction of road traffic noise, the DMRB HD 213/11 states the use of the methodology described in the technical memorandum Calculation of Road Traffic Noise (CRTN) 1988 (Ref 12.2). The DMRB HD 213/11 Annex 4 provides additional guidance on the use of CRTN which was also followed.

12.3.33 The outputs of CRTN are noise levels from road traffic in dB $L_{A10,18h}$, which are representative of the noise levels between 6am and midnight. The DMRB HD 213/11 provides a methodology to relate noise levels and average nuisance due to both noise and airborne vibration.

12.3.34 The traffic data is obtained from the transportation engineers. Details on the traffic model are presented in Chapter 2, Section 2.4: Traffic data.

Sensitivity of receptors

12.3.35 The DMRB does not provide a methodology to assign significance for noise impacts. To overcome this lack of methodology in the DMRB, this chapter uses the criteria in the Technical Advice Note (TAN) Assessment of noise 2011 (Ref. 12.14). In TAN 2011, the significance of impact is defined from the sensitivity or receptor and the magnitude of impact. The sensitivity of receptor is defined in line with Table 12.4. Both residential and community receptors used in the assessment were classified as high sensitivity.

Table 12.4: Sensitivity of receptor to permanent noise impacts

Sensitivity	Description	Examples of noise sensitive receptors
High	Receptors where people or operations are particularly susceptible to noise	• Residential, including private gardens where appropriate. • Quiet outdoor areas used for recreation • Conference facilities • Theatres/Auditoria/Studios • Schools during the daytime • Hospitals/residential care homes • Places of worship
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	• Offices • Bars/Cafes/Restaurants where external noise may be intrusive. • Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls)
Low	Receptors where distraction or disturbance from noise is minimal	• Buildings not occupied during working hours • Factories and working environments with existing high noise levels • Sports grounds when spectator noise is a normal part of the event • Night Clubs

Magnitude of impacts

12.3.36 The DMRB states that if the magnitude of change in noise levels is above 1 dB in the short term (opening year) or 3 dB in the long term (typically after 15 years), this is considered to be a perceptible impact. The magnitude of change in noise levels within road projects is determined by comparing the following assessment scenarios:

- Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year (short term).
- Do-Minimum scenario in the baseline year against Do-Minimum scenario in the future assessment year (long term Do-Minimum).

- Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year (long term Do-Something).

12.3.37 For night-time noise impacts (on permanent impacts), only comparisons in the long term are considered.

12.3.38 Do-Minimum scenarios are scenarios with no scheme in place, whereas Do-Something scenarios are scenarios with the scheme in place. In all the scenarios, the traffic model includes the predicted traffic growth.

12.3.39 The assessment considers the opening year as 2018 and the future assessment year is 2022. Typically the DMRB states that the future year is 15 years from the opening year, however the traffic model forecast demands within the detailed S-Paramics models, showed that the forecast traffic levels on the A737 mainline created operational issues throughout the model in the later forecast years. The model showed significant queuing developing on approach to Manrahead Roundabout and Clerksbridge Toll Roundabout (north of Roebank Road). This occurred in forecast years 2027 onwards and suggests that this level of growth would not be accommodated by the trunk road network without significant improvements along the length of the A737. For this reason, growth has been capped at 2022 as being the worst affected year. All future year assessment beyond 2022 will use 2022 traffic values.

12.3.40 The change in noise levels between the scenarios are classified using the DMRB magnitude of impacts as shown in Tables 12.5 and 12.6 for the opening year and the future assessment year.

Table 12.5: Classification of magnitude of noise impact in the short term

Noise change, dB $L_{A10, 18h}$, daytime dB $L_{night, outside}$ Night		**Magnitude of impact**
Increase	5+	Major adverse
	3 – 4.9	Moderate adverse
	1 – 2.9	Minor adverse
	0.1 – 0.9	Negligible adverse
No change	0	No change
Decrease	0.1 – 0.9	Negligible beneficial
	1 – 2.9	Minor beneficial
	3 – 4.9	Moderate beneficial

Noise change, dB $L_{A10, 18h}$, daytime dB $L_{night, outside}$ Night		**Magnitude of impact**
	5+	Major beneficial

Table 12.6: Classification of magnitude of noise impact in the long term

Noise change, dB $L_{A10, 18h}$, daytime dB $L_{night, outside}$ Night		**Magnitude of impact**
Increase	10+	Major adverse
	5 – 9.9	Moderate adverse
	3 – 4.9	Minor adverse
	0.1 – 2.9	Negligible adverse
No change	0	No change
Decrease	0.1 – 2.9	Negligible beneficial
	3 – 4.9	Minor beneficial
	5 – 9.9	Moderate beneficial
	10+	Major beneficial

Significance of impact

12.3.41 The significance of impact is defined from the sensitivity of receptor and the magnitude of impact in line with TAN Assessment of noise 2011 as reproduced in Table 12.7 below.

Table 12.7: Significance of permanent impacts

Magnitude of Impact	**Level of Significance relative to Sensitivity of Receptor**		
	Low	**Medium**	**High**
Major	Slight/Moderate	Moderate/Large	Large/Very Large
Moderate	Slight	Moderate	Moderate/Large
Minor	Neutral/Slight	Slight	Slight/Moderate
Negligible	Neutral/Slight	Neutral/Slight	Slight
No change	Neutral	Neutral	Neutral

12.3.42 The level of significance and its relevance to the decision making process is explained in TAN 2011 and is reproduced in Table 12.8 below.

Table 12.8: Description of the level of significance

Significance	Description
Very Large	These impacts[1] represent key factors in the decision-making process. They are generally, but not exclusively, associated with impacts where mitigation is not practical or would be ineffective.
Large	These impacts are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse impacts are likely to have a Moderate or Slight significance.
Moderate	These impacts, if adverse, while important, are not likely to be key decision making issues.
Slight	These impacts may be raised but are unlikely to be of importance in the decision making process.
Neutral	No impacts, not significant, noise need not be considered as a determining factor in the decision making process.
[1] TAN 2011 uses the term significance of impacts rather than significance of impacts as used in this ES.	

12.3.43 Where the overall impact in the long term is expected to be 'moderate adverse' or greater, the impact is likely to be considered significant. Therefore, as best practice, mitigation should be implemented, where practicable, where the significance of impact in the long term is expected to be "moderate adverse" or worse.

Vibration

12.3.44 The DMRB outlines a method for the assessment of traffic induced vibration and this includes the assessment of the numbers of people bothered by airborne vibration. It states that vibration associated with road traffic sources would not normally have any influence at distances outside of 40m from an affected road. As such the assessment of vibration was limited to buildings within 40m of the centre line of the scheme. Additionally, as recommended by DMRB, only properties which have predicted traffic noise levels greater than 58dB $L_{A10,18h}$ were considered.

12.3.45 Ground borne vibration is not anticipated to be a major issue for the scheme as ground borne vibrations are only generally perceptible where the road surface is uneven. It is

assumed that the road surface will be subject to regular maintenance and therefore it is not expected that there will be uneven road surfaces along the scheme. Consequently, operational ground borne vibration has been scoped out.

Noise and nuisance

12.3.46 A nuisance noise impact assessment is undertaken for all dwellings in the study calculation area using Annex 6 (Figures A6.1 and A6.2) HD 213/11 DMRB (Ref 12.1). However, when the change in nuisance followed the curve in the DMRB Figure A6.2 (nuisance from changes in the short term) this was only applied when the noise level was at least 65dB $L_{A10,18h}$ that it is the range from where that curve was derived. This Annex provides the relationship between traffic noise and perceived traffic noise nuisance. This is expressed as the percentage of people bothered by the noise source.

12.3.47 The dwellings are categorised into the noise nuisance change bands either by an increase or decrease in nuisance level such as 0-10%, 10-20%, 20-30%, 30-40% and greater than 40%.

Mitigation

12.3.48 Where the overall impact in the long term is expected to be greater than 'slight adverse', the impact is considered to be significant. Therefore, as best practice, mitigation should be implemented, where practicable, where the significance of impact in the long term is expected to be "moderate adverse" or worse.

12.3.49 Practicable mitigation measures beyond the horizontal and vertical realignment of the road are the provision of noise barriers in the form of earth bunds or vertical barriers and the provision of low noise surface.

12.3.50 The WHO provides guideline values to protect people from being annoyed during the daytime. To prevent serious annoyance, the outdoor sound level should not exceed 55dB $L_{Aeq,16h,free\text{-}field}$ on balconies, terraces and indoor living areas, and to prevent moderate annoyance they should not exceed 50dB $L_{Aeq,16h,free\text{-}field}$. Where this is feasible this should be reduced where practicable to a desired sound level.

12.3.51 The WHO refers to a daytime base of 16 hours ($L_{Aeq,16h}$) and CRTN predictions are in terms of $L_{A10,18h}$. To translate the WHO $L_{Aeq,16h}$ to $L_{A10,18h}$, a correction of approximately +2dB is required, with a further +2.5dB to translate into façade levels. This translation applied to a 50dB $L_{Aeq,16h}$ gives an equivalent threshold façade levels of 54.5dB $L_{A10,18h}$. Where noise levels are below 54.5dB $L_{A10,18h}$ (and therefore the noise levels would not

cause nuisance) and the area is not defined as a quiet area, mitigation has not been considered necessary unless the significance of impact was large adverse.

Noise Insulation (Scotland) Regulations

12.3.52 Part 1 of the Land Compensation (Scotland) Act (Ref 12.9) provides a means by which compensation can be paid to owners of land or property which has experienced a loss in value from improved roads.

12.3.53 The Noise Insulation (Scotland) Regulations 1975 (Ref 12.11) provide for acoustic insulation to be offered for residential properties. The qualifying criteria are detailed within the Regulations and within the Memorandum on the Noise Insulation (Scotland) Regulations 1975 (NI(S)R), Regulations 3 and 6 (Ref 12.2726) (Part of the STO S069 (Ref. 12.12).

12.3.54 The predicted noise levels at each façade of each property, determined using the proprietary noise modelling software NoiseMap, is used to carry out an initial assessment of the likelihood of any properties qualifying under the Noise Insulations (Scotland) Regulations (Ref 12.11). Regulation 3 imposes a duty on authorities to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings. This is subject to meeting certain criteria given in the Regulation. Regulation 4 provides authorities with discretionary powers to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings, subject to meeting certain criteria given in the Regulation. . The regulations only apply to habitable rooms.

12.3.55 To be eligible for noise insulation, the following criteria from NISR are required:

- The combined expected maximum traffic noise level, ie the relevant noise level, from the new or altered carriageway together with other traffic in the vicinity must not be less than the specified noise level, 68dB $L_{A10,18h}$ (with values of 67.5dB being rounded up).
- The relevant noise level is at least 1.0dB(A) more than the prevailing noise levels, ie the total traffic noise level existing before the works to improve the carriageway has commenced.

- The relevant properties are within 300m of the new altered carriageway or at the end of the scheme and 300m from the side of the scheme and a straight line can be drawn from the property to the new or altered carriageway without passing through another building.

12.4 Baseline conditions

12.4.1 Baseline noise levels are defined as noise levels before the scheme is in place, in the absence of any construction activities. The baseline conditions are predicted from detailed computer modelling described in the methodology paragraphs 12.3.30 to 12.3.34 which predicts existing noise levels from road traffic. To better understand the existing noise climate, noise baseline surveys were undertaken to provide a comparison with the predicted baseline from the model to allow for non-road related noise sources (such as rail, industrial and aircraft) to be taken into consideration if necessary.

Desk study

12.4.2 The study area is rural in nature with Beith town, including residential, community and commercial properties located to the west and scattered receptors and farmland to the east. The existing A737 is screened by a tree line along Larch Terrace and Glebelands Way.

12.4.3 Receptors located within 300m of the study area which includes the existing A737 and the new roads are identified within Table 12.9 within respective distance bands. The study area is illustrated within Figure 12.1.

Table 12.9: Number of sensitive receptors within 300m of the study area

		0-50m	50-100m	100-200m	200-300m	Total
Study Area	Residential	174	228	358	348	1108
	Commercial	1	1	0	1	3
	Community	1	1	0	5	7

12.4.4 The A737 was included in the Second Round of strategic mapping carried out by the Scottish Government. The Transportation Noise Action Plan by Transport Scotland identified no Candidate Noise Management Areas (CNMA) within the study area. (Ref 12.20 to 12.22.

12.4.5 No AONB, National Park, SAC, SPA, or SSSI designated sites are located within the study area.

12.4.6 Beith Conservation Area is located along New Street, Eglington Street, Main Street and a part of Barrmill Road. The area consists of Category A, B and C Listed Buildings. A church (Category B) is located within the area. The nearest point of the Conservation Area is located approximately 300m from the A737 carriageway near to Glebe Road. Beith Conservation Area is further assessed within Chapter 7 Cultural Heritage and Chapter 8 Landscape Impacts.

12.4.7 Consultation with North Ayrshire Council confirmed that Environmental Health do not hold any data regarding existing noise levels at this area.

Baseline noise survey

12.4.8 A noise survey was carried out on 7 - 9 October 2014 and on 3 December 2015 at sample sensitive locations to establish the ambient noise levels in the area. Weather conditions were favourable for a noise survey as there was no precipitation and very light winds during both surveys. Details of the noise survey together with calibration certificates for the survey equipment are included in Appendix 12.1 and 12.2. During the site visits the surveyor's observations were noted and the main noise source in the area was recorded as road traffic. However, additional noise sources in the area include pedestrian activity, birds calling, aircraft noise and agricultural activity. During the survey it was observed that the traffic queued back to 18 Wardrop Street.

12.4.9 A summary of short-term measured ambient noise levels undertaken over October 2014 and December 2015 are provided in Table 12.10. The locations of the monitoring points are illustrated within Figure 12.2.

Table 12.10: Summary of short-term measured noise levels (free-field)

Location	Approx. distance to the existing A737 (m)	$L_{A10,45min}$	$L_{A10,18h*}$	$L_{A90,15min}$
ML1a	5	70.3	68.3	55.7
ML1b	12	64.9	62.9	53.4
ML1	14	68.1	66.1	62.0
ML2	60	63.6	61.6	49.0
ML3	30	56.1	54.1	46.3
ML4	20	61.4	59.4	50.8
ML5	155	57.7	55.7	49.7

Location	Approx. distance to the existing A737 (m)	$L_{A10,45min}$	$L_{A10,18h}$*	$L_{A90,15min}$
*Conversion to $LA_{10,18h}$ was made using the Instruction 2/92 (STO S069) methodology $LA_{10,18h}$ = $LA_{10,15min}$ - 2dB(A) taking the $LA_{10,15min}$ as the average of three LA10,15min measurements totalling $LA_{10,45min}$.				

Noise modelling

12.4.10 From the noise model study area, there are 1,111[1] residential and community properties. An illustration of the representative receptors are shown in Figure 12.1. The full results of all scenarios assessed of each receptor and façade is illustrated within Appendix 12.3. Table 12.10 identifies the distance change and the predicted Do-Minimum road traffic noise levels from the model at each representative receptor.

Table 12.11: Representative receptors, distance and predicted baseline noise levels

Noise sensitive receptor (façade)	Distance from the A737 carriageway (m)			Predicted baseline noise levels (dB) 2018	
	Existing road (m)	Scheme (m)	Change (m)	Daytime $L_{A10,18h}$ (6am to 12am)	Night time $L_{night\ outside}$ (11pm to 7am)
11 Wardrop Terrace (E)	8	14	+6	73.9	60.2
18 Wardrop Street (N)	56	14	-42	69.0	55.8
18 Wardrop Street (S)				60.6	48.3
24 Larch Terrace (E)	41	63	+22	63.7	51.1
45 Barrmill Road (N)	108	15	-93	61.8	49.4
45 Barrmill Road (E)				61.9	49.4
10d Barrmill Road (NE)	180	267	+87	60.4	48.1
12 Barrmill Road (W)	10	56	+46	70.6	57.3

[1] These figures differ from the values given in Table 12.9 of 1108 residential receptors and 2 community receptors. The reason for this is that 4 OS AddressBase residential receptors were not included in any building and that during the site visit it was annotated that 2 buildings classified as residential in the OS AddressBase located within the Geilsland School complex were actually community buildings.

Noise sensitive receptor (façade)	Distance from the A737 carriageway (m)			Predicted baseline noise levels (dB) 2018	
	Existing road (m)	Scheme (m)	Change (m)	Daytime $L_{A10,18h}$ (6am to 12am)	Night time $L_{night\ outside}$ (11pm to 7am)
12 Barrmill Road (E)				62.2	49.7
16 Barrmill Road (SW)	35	24	-11	55.0	43.2
16 Barrmill Road (SE)				65.0	52.2
2 Spiersland Way (N)	125	29	-96	56.6	44.7
43 Glebelands Way (SE)	19.0	112	93	69.5	56.3
35 Dalry Road (S)	14	9	-5	67.4	54.4
Manrahead Farm (N)	145	124	-22	58.1	46.0
Geilsland School (W)	15	95	-56	55.6	43.7

12.4.11 Table 12.11 illustrates the distance change from the representative receptors to the A737 with the scheme in place; however some receptors are closer to other carriageways. The main traffic noise source experienced from some of the representative receptors include:

- 18 Wardrop Street – Wardrop Street is directly in front (approximately 3.5m) of the property and the traffic congests at the junction. This is a route to Gateside village and is used heavily with heavy goods vehicles.
- 11 Wardrop Terrace – the property will experience traffic noise from Head Street (approximately 9.2m) as well as the A737 carriageway.
- 10d, 12, 16 and 45 Barrmill Road will experience traffic noise from Barrmill Road as well as the A737. In particular 45 Barrmill Road is approximately 107m from the existing A737 carriageway whereas the Barrmill Road is located 17.6m from the receptor.
- 2 Spiersland Way – the existing A737 is located 124.7m from the property, however the A737 is 44.5m to Barrmill Road. However, 45 Barrmill Road screens the property from the noise levels.

Comparison with measured and (modelled) predicted traffic noise levels (free-field)

12.4.12 Table 12.12 shows the comparison between the noise levels measured in the noise survey and the noise levels predicted in the noise model. The results from the National Noise Survey carried out by the Building Research Establishment in 2000 (Ref 12.28) and reported in the DRMB HD 213/11 Table A4.1 stated that the standard error between measured and modelled noise levels (the latter modelled under CRTN) is around 1.9dB $L_{A10,18h}$. Therefore, when the difference between the measured and modelled results is within 2 standard errors (±3.8 dB), it can be stated that the noise modelling reflects the existing noise level in the area within a 95% confidence level.

12.4.13 Consequently, it is considered that the main noise source in the area is traffic noise and that the traffic model (and the noise model derived from the same) used are a good representation of the actual noise levels in the area. Some of the differences between measured and modelled results in Table 12.12 may be caused by punctual traffic congestion at junctions during measurements, different weather conditions (the CRTN assumes a downwind direction with a speed of 2m/s) and local noise sources experienced during the on-site monitoring.

Table 12.12: Comparison of measured and modelled (predicted) noise levels and confidence that the measured noise levels are from road traffic noise included in the model

Position	Measured dB $L_{A10,18h}$	Modelled dB $L_{A10,18h}$	Modelled – measured	Within 95% confidence level
Head Street	68.7	66.7	-2.0	Yes
10d Barrmill Road	64.1	60.4	-3.7	Yes
16 Barrmill Road	56.7	55.0	-1.7	Yes
45 Barrmill Road	61.9	61.9	0.0	Yes
Geilsland School	58.2	57.0	-1.2	Yes

12.5 Construction impact assessment

Noise

12.5.1 Full details of construction works are not available at this stage, however a generic estimate based on previous experience is set out in the following paragraphs.

Construction details are further detailed in Chapter 3 Construction, Operation and Maintenance.

12.5.2 BS 5228 (Ref 12.24) contains reference noise levels of different construction equipment and activities in order to predict noise levels at receptors. The following provides an overview of typical activities:

- Site clearance – equipment and plant would include pneumatic breakers, planers, compressors, excavators, circular saw for the removal of vegetation and lorries for removal of materials.
- Construction of earthworks – bulldozer, articulated dump trucks and dumpers for rubble and excavator.
- Construction of road pavement – includes rollers, vibratory roller and compactor, asphalt paver, tippers and lorries and removal and delivery of materials and waste.

12.5.3 For the purposes of the assessment construction activities are assessed as the following:

1. Site clearance
2. Earthworks
3. Road planing
4. Rolling and compaction
5. Paving

12.5.4 For the purposes of this assessment it is assumed that the majority of construction works will normally take place between 7am and 7pm Monday to Friday and between 7am and 1pm on a Saturday.

12.5.5 At this stage, it is not known if blasting of the rock at Barrmill Road will be required as part of the earthworks and it has not been considered here. Therefore, if rock blasting is required, the construction noise assessment will need to be updated accordingly.

12.5.6 The sensitivity of an area to construction noise depends on the existing noise levels in that area before any construction takes place (see Table 12.2 above). The noise levels at the closest properties to the existing road are relatively high due to the road traffic noise and they meet the criteria to be classified as an area of Category B. However, the noise levels at the properties that are further away from the existing road are lower and they meet the criteria to be classified as an area of Category A which is more sensitive to

construction noise (and therefore the threshold of potential adverse impacts is lower) than an area of Category B.

12.5.7 In this case, most of the closest properties to the construction works are now in an area far from the existing road and therefore they are in an area of Category A. Consequently, the potential significance of construction works has been assessed against the daytime threshold value for Category A which is 65 dB $L_{Aeq,12h,(7am-7pm)}$ Monday to Friday and 65 dB $L_{Aeq,6h,(7am-1pm)}$ on Saturdays (see further details in Table 12.2 above reproduced from BS 5228-1 Table E.1). Neither daytime working during Sundays and public holidays nor evening or night time working are anticipated.

12.5.8 The construction noise assessment predicts the noise levels at the closest receptors to the construction works which are considered as representative of the worst-case scenario. The noise levels at these representative receptors were modelled according to BS 5228-1 using the proprietary software NoiseMap 5. The representative receptors for construction are illustrated within Figure 12.1.

12.5.9 Table 12.13 shows the expected construction noise levels at the most affected façade of different representative receptors which represent a worst-case scenario. These predicted noise levels are compared to the daytime threshold of potential significant adverse impact and the output is reported in the last column of Table 12.13.

12.5.10 The output in the last column shows that construction works will cause potential significant adverse impacts at most of the closest sensitive receptors at almost all stages. The only exception is 35 Dalry Road where the noise levels are not expected to exceed the threshold of significance during the site clearance, rolling, compaction and paving of Manrahead Roundabout.

Table 12.13: Predicted construction noise levels at representative receptors and potential significance of impact during daytime

Sensitive receptor (façade)	**Construction stage**	**Predicted construction noise level dB $L_{Aeq,1h}$**	**Category A significance threshold for daytime dB $L_{Aeq,12h,weekday}$ dB $L_{Aeq,6h,Saturday}$**	**Significant Y or N**
45 Barrmill Road (N)	Site clearance	69	65	Y
	Earthworks	74	65*	Y

Sensitive receptor (façade)	Construction stage	Predicted construction noise level dB $L_{Aeq,1h}$	Category A significance threshold for daytime dB $L_{Aeq,12h,weekday}$ dB $L_{Aeq,6h,Saturday}$	Significant Y or N
	Road planning	76	65	Y
	Rolling and compaction	70	65	Y
	Paving	71	65	Y
16 Barrmill Road (SE)	Site clearance	67	65	Y
	Earthworks	72	65*	Y
	Road planning	72	65	Y
	Rolling and compaction	66	65	Y
	Paving	67	65	Y
11 Wardrop Terrace(S)	Site clearance	67	65	Y
	Earthworks	72	65*	Y
	Road planning	77	65	Y
	Rolling and compaction	71	65	Y
	Paving	72	65	Y
20 Wardrop Street (N)	Site Clearance	70	65	Y
	Earthworks	75	65*	Y
	Road planning	76	65	Y
	Rolling and compaction	70	65	Y
	Paving	71	65	Y
35 Dalry Road (S)	Site Clearance	62	65	N
	Earthworks	67	65*	Y
	Road planning	67	65	Y
	Rolling and compaction	61	65	N
	Paving	62	65	N

Sensitive receptor (façade)	Construction stage	Predicted construction noise level dB $L_{Aeq,1h}$	Category A significance threshold for daytime dB $L_{Aeq,12h,weekday}$ dB $L_{Aeq,6h,Saturday}$	Significant Y or N
* Long term substantial earth moving: As stated in paragraph 12.3.19 above, where construction activities involve large scale and long term earth moving activities, BS 5228-1 section E.5 suggests that a limit of 55 dB $L_{Aeq,1h}$ should be adopted for daytime construction noise for these type of activities, where the works are likely to occur for a period in excess of six months.				

Noise insulation (Scotland) regulation 1975

12.5.11 Table 12.14 shows the representative properties where noise levels could reach the threshold for the provision of noise insulation as proposed in STO S069 and BS 5228-1 section E.4. These are located around the junction of Head Street and Wardrop Street and at 16 and 45 Barrmill Road.

12.5.12 The last column in Table 12.14 states the actions that should be considered in order to avoid the need for the provision of noise insulation. However, as there are only a few properties that would meet the criteria, it might be most cost impactive to offer insulation to those properties under Regulation 5 of the NISR rather than reducing the impact of construction noise by other means.

Table 12.14: Comparison of predicted construction noise levels to the noise insulation criteria stated in Table 12.3 above

Sensitive receptor (façade)	Construction stage	Predicted construction noise level dB $L_{Aeq,1h}$	Relevant threshold (see Table 12.3)	Output in order to avoid the need for insulation
45 Barrmill Road (N)	Site clearance	69	Monday to Friday 75 dB $L_{Aeq,12h,(7am-7pm)}$ for 1 month or more Monday to Friday	Note 1
	Earthworks	74		Note 2
	Road planning	76		Note 3
	Rolling and compaction	70		Note 2
	Paving	71		Note 2

Sensitive receptor (façade)	Construction stage	Predicted construction noise level dB $L_{Aeq,1h}$	Relevant threshold (see Table 12.3)	Output in order to avoid the need for insulation
16 Barrmill Road(SE)	Earthworks	72	70 dB $L_{Aeq,12h,(7am-7pm)}$ for 2 months or more Saturday 70 $L_{Aeq,1h,(7am-8am)}$ 75 dB $L_{Aeq,5h,(8am-1pm)}$ for more than 10 days any 15 or more than 40 days any 6 months	Note 2
	Road planning	72		Note 2
11 Wardrop Terrace (S)	Earthworks	72		Note 2
	Road planning	77		Note 3
	Rolling and compaction	71		Note 2
	Paving	72		Note 2
20 Wardrop Street (N)	Site Clearance	70		Note 2
	Earthworks	75		Note 3
	Road planning	76		Note 3
	Rolling and compaction	70		Note 2
	Paving	71		Note 2

Note 1: If these works were undertaken without further mitigation they should be restricted to 7am to 7pm Monday to Friday and to 8am to 1pm on Saturdays from 7am to 8am on Saturdays.

Note 2: If these works were undertaken without further mitigation they should be restricted to the same working times as the ones in Note 1 or avoid maintaining these levels for more than 2 months Monday to Friday or for more than ten or more days of working in any fifteen consecutive days or for a total of days exceeding 40 in any 6 month period on Saturdays. Otherwise, the provision of noise insulation on those properties (and other that could show similar construction noise levels) should be considered.

Note 3: If these works were undertaken without further mitigation they should be restricted to the same working times as the ones in Note 1 or avoid maintaining these levels for more than 1 month Monday to Friday or for more than ten or more days of working in any fifteen consecutive days or for a total of days exceeding 40 in any 6 month period on Saturdays. Otherwise, the provision of noise insulation on those properties (and other that could show similar construction noise levels) should be considered.

12.6 Construction mitigation

12.6.1 Section 12.6 above concluded that significant adverse impacts although not widespread are likely to exist at properties around Manrahead Roundabout, the area around 16 and 45 Barrmill Road and the area in the vicinity of the crossing of Head Street and Wardrop Street.

12.6.2 Therefore, construction works will need to include mitigation measures such as the use of "Best practicable means" as defined in Section 72 of the Control of Pollution Act 1974. They may also consider following codes of practice for minimising noise such as the ones approved in relation to Section 71 of the Control of Pollution Act 1974.

12.6.3 Section 72 of the Act states in relation to best practicable means that:

- "(2) In that expression "practicable" means reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications.
- (3) The means to be employed include the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and acoustic structures.
- (4) The test of best practicable means is to apply only so far as compatible with any duty imposed by law, and in particular is to apply to statutory undertakers only so far as compatible with the duties imposed on them in their capacity of statutory undertakers.
- (5) The said test is to apply only so far as compatible with safety and safe working conditions, and with the exigencies of any emergency or unforeseeable circumstances."

12.6.4 Therefore, in order to mitigate the significant impacts from construction noise, general principles of construction site noise control will be followed according to the guidance given in BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise, and BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration (Ref 12.24).

12.6.5 Further screening will also be used to provide additional screening around long-term static plant (eg generators) at locations where the boundary screening might not be

impactive such as areas of raised ground where there might be a clear line of sight between source and receiver.

12.6.6 Plant machinery such as generators or compressors will be positioned as far from noise sensitive locations as possible such as properties surrounding 12 Barrmill Road and properties at Wardrop Street.

12.6.7 All plant equipment will be adequately maintained to minimise noise emission. Measures will be adopted according to "Best practicable means" which includes measures such as specification of plant equipment, hours of operation and HGV access routes. Specific noise control practices shall be agreed between the contractor and the local authority if appropriate.

Operating methods of noise reduction

12.6.8 The following mitigation measures will be put in place during construction to mitigate noise impacts:

- Ensure that all staff and operatives are briefed on the equipment to minimise nuisance from site activities.
- Plant and machinery shall only operate at manufacturers' rated working levels.
- No inappropriate use is acceptable such as revving machinery unnecessarily and not left running if not in use.
- Materials should be moved in transit or dropped on site should carried out at the minimise height practicable to ensure noise reduction.

Noise reduction of mobile plant

12.6.9 Any movement of vehicles, plant and machinery on site should only be undertaken during the normal operating hours and away from any sensitive receptors, if possible.

12.6.10 Haul routes within the site should be planned, maintained and avoid steep gradients where practicable.

12.6.11 The programme of works should be phased to reduce the impact to noise sensitive receptors. The scheme footprint is largely offline, the tie-ins to the existing alignment should be phased at the end of the programme. The location of the site compound has not been determined and will be selected by the contractor. However, to ensure minimal impact the location should be far as possible from any noise sensitive locations.

Noise propagation on site

12.6.12 Temporary barriers, such as hoardings or earth bunds when positioned close to the source or the receiver will assist in the reduction of noise levels experienced at the closet receptors. Barriers should be a uniform panel, with no holes or gaps on even ground at a height and width more than enough to cut off the sight of the source from the receiver.

Community liaison

12.6.13 The contractor shall ensure that all residents and surrounding businesses are kept informed about any disturbance such as unavoidable noise and vibration disruption. Information shall be provided well in advance by media and by letter drop to properties directly adjacent to the works.

12.6.14 The site shall have a procedure in place in the event of complaint being made. The site manager should make their details (telephone number) known to the residents who can take immediate action to rectified the complaint.

12.6.15 All complaints concerning the works/activities must be recorded within a register and made available to the Local Authority, if requested. The register shall provide all information from details of the complaint, date, times to measures put in place to ensure the complaint has been dealt with. Details of any monitoring should be noted.

Construction Noise Monitoring

12.6.16 It is not known the exact programme of works at this stage, in the event that the construction methods change, construction noise monitoring will be required. However, this will be further implemented at detailed design stage.

12.7 Construction residual impacts

12.7.1 During the works programme it is anticipated that the increase in the noise levels will be unavoidable for isolated receptors within the study area such as at Head Street/Wardrop Street Junction, Manrahead Roundabout, 16 Barrmill Road and 45 Barrmill Road. However, during such times the contractor should proactively liaise with the community at all times and implement an appropriate mitigation strategy by using best practice means to minimise construction impacts. Construction impacts are considered temporary in nature lasting for 12 months for the duration of the works. Mitigation measures will be incorporated into the Construction Environmental Management Plan to ensure that noise impacts are kept to a minimum.

12.7.2 The above measures should avoid the need for provision of noise insulation to the closest properties. However, noise insulation may be considered at some specific property if necessary.

12.7.3 Therefore, considering the mitigation measures stated above and the fact that construction noise is unavoidable, significant impacts to some properties, in particular properties surrounding Head Street Junction and 16, 45 Barrmill Road and 2 Spiersland Way are determined. With the works being limited to daytime, it is concluded that the construction impacts will be reduced and monitored during the duration of the works.

12.7.4 At this stage, it is not known if blasting of the rock at Barrmill Road will be required as part of the earthworks and it has not been considered in this assessment. Therefore, if rock blasting was required, the construction noise assessment will need to be updated accordingly.

12.8 Permanent impact assessment

Noise and vibration assessment – short-term

12.8.1 Short-term impacts due to traffic noise have been assessed comparing the Do-Minimum scenario in the baseline year 2018 against the Do-Something scenario in the baseline year 2018 (ie Do-Something 2018 minus Do-Minimum 2018).

12.8.2 In the first instance, the results at the most representative façade (usually the façade facing the scheme) for some representative receptors are presented and discussed. Following this, the results for all the receptors within the calculation area are presented in summary tables as stated in the DMRB HD 213/11. The façade in the summary tables is the façade with the highest increase or lowest decrease in noise levels as stated in the DMRB HD 213/11. This façade may be or may be not the same as reported in the tables of representative receptors.

12.8.3 Figure 12.3 illustrates the noise contour levels for the scheme in the short term (opening year) comparing with and without the scheme in place. Table 12.15 shows the short term comparison at some representative receptors.

12.8.4 The complete list for all the receptors and all the façades is reproduced in Appendix 12.3.

Table 12.15: Short-term (opening year) noise levels at the representative receptors– without mitigation

Do-Something baseline year 2018 – Do-Minimum baseline year 2018 (short-term)				
Receptor (façade)	**DM 18 (dB $L_{A10,18h}$)**	**DS 18 (dB $L_{A10,18h}$)**	**Change in noise (dB $L_{A10,18h}$)**	**Magnitude of Impact**
11 Wardrop Terrace (E)	73.9	68.7	-5.2	Major beneficial
18 Wardrop Street (N)	69.0	66.8	-2.2	Minor beneficial
18 Wardrop Street (S)	60.6	63.4	+2.8	Minor adverse
24 Larch Terrace (E)	63.7	59.7	-4.0	Moderate beneficial
45 Barrmill Road (N)	61.8	68.6	+6.8	Major adverse
45 Barrmill Road (E)	61.9	63.1	+1.2	Minor adverse
10d Barrmill Road (NE)	60.4	57.3	-3.1	Moderate beneficial
12 Barrmill Road (W)	70.6	56.9	-13.7	Major beneficial
12 Barrmill Road (E)	62.2	63.7	+1.5	Minor adverse
16 Barrmill Road (SE)	55.0	65.2	+10.2	Major adverse
16 Barrmill Road (SW)	65.0	64.3	-0.7	Negligible beneficial
2 Spiersland Way (W)	56.6	64.9	+8.3	Major adverse
43 Glebelands Way (SE)	69.5	58.7	-10.8	Major beneficial
35 Dalry Road (S)	67.4	65.3	-2.1	Minor beneficial
Manrahead Farm (S)	56.9	56.6	-0.3	Negligible beneficial
Geilsland School (W)	55.6	56.8	+1.2	Minor adverse

12.8.5 Table 12.15 illustrates that the highest increases in noise with the proposed scheme in place in the opening year are at three isolated residential receptors located to the east of the A737 in a rural surrounding. These are 16 and 45 Barrmill Road and 2 Spiersland Way. The increases in noise levels vary between 6.8 and 10.2dB(A). The magnitude of impact with the scheme in place results in these properties experiencing is major adverse.

12.8.6 The property at 16 Barrmill Road will also experience a decrease in noise at the front of the property as Barrmill Road will be stopped up at this location and will become a private access for the property.

12.8.7 The residential receptors along Larch Terrace, Glebelands Way and 12 Barrmill Road will experience a reduction in the noise levels as the A737 is moving further from them. This is shown in Table 12.15 with receptor 43 Glebelands Way experiencing a decrease in levels by 10.8dB(A). A reduction of 10dB(A) results in the sound pressure level experienced by humans being halved. 12 Barrmill Road will experience a decrease in noise levels at the front of the property by 13.7dB(A), however as the A737 and Barrmill roundabout moves to the back of the property noise levels increase at the back of the property by 1.5dB(A). The roundabout is slightly in cutting whereas the existing alignment results in traffic from the A737 and Barrmill Road passing the front of the property. The magnitude of impact at these properties is considered to be major beneficial.

12.8.8 The short-term total traffic noise level changes (taking the worst case façade) are shown in Table 12.16. This includes the 1102 residential and 9 community receptors within the study area[2]. The table shows that 28 dwellings will experience an increase in noise levels of at least 1dB(A) which is the minimum change considered perceptible in the short term. Of these 28 dwelings, 6 dwellings will experience an increase in noise levels of over 5 dB(A). Conversely, 121 dwellings will see a perceptible decrease in noise levels of at least 1dB(A).

12.8.9 The rest of the properties will see negligible changes or no changes in their worst case façade (ie the façade with the highest increase or the lowest decrease in noise levels).

12.8.10 There are 4 community receptors where the changes in noise levels result in a perceptible change of more than 1dB(A). These are individual buildings within Geilsland School boundary.

[2] These figures differ from the values given in Table 12.9 of 1108 residential receptors and 2 community receptors. The reason for this is that 4 OS AddressBase residential receptors were not included in any building and that during the site visit it was annotated that 2 buildings classified as residential in the OS AddressBase located within the Geilsland School complex were actually community buildings.

Table 12.16: Short-term noise impact - without mitigation

Do-Something baseline year 2018 – Do-Minimum baseline year 2018 (short-term)			
Change in noise level		**Daytime**	
		Number of dwellings	**Number of other sensitive receptors**
Increase in noise level $L_{A10,18h}$	0.1 – 0.9	514	4
	1.0 – 2.9	22	1
	3.0 – 4.9	0	2
	5+	6	1
No Change	0	198	0
Decrease in noise level, $L_{A10,18h}$	0.1 – 0.9	241	0
	1.0 – 2.9	103	1
	3.0 – 4.9	11	0
	5+	7	0

Noise and vibration assessment – long-term

Long term Do-Minimum comparison

12.8.11 The long-term traffic noise assessment includes the daytime assessment, the night-time noise assessment and the airborne vibration assessment.

12.8.12 The long-term Do-Minimum comparative compares the Do-Minimum scenario in the baseline year 2018 against the Do-Minimum scenario in the future assessment year 2022 (ie Do-Minimum 2022 minus Do-Minimum 2018). This is the natural increase in traffic flow on the existing route with no improvements in place other than maintenance of the existing road.

12.8.13 The results for the receptors considered as representative of different areas are reproduced in Table 12.17.

Table 12.17: Long-term maximum noise levels at the representative receptors - without mitigation

Do-Minimum design year 2022 – Do-Minimum baseline year 2018 (long-term)						
Receptor	**Daytime (dB $L_{A10,18h}$)**			**Night-time (dB $L_{night,outside}$)**		
	DM18	**DM22**	**Change**	**DM18**	**DM22**	**Change**
11 Wardrop Terrace (E)	73.9	74.0	+0.1	60.2	60.3	+0.1
18 Wardrop Street (N)	69.0	69.1	+0.1	55.8	55.9	+0.1
18 Wardrop Street (S)	60.6	60.8	+0.2	48.3	48.5	n/a
24 Larch Terrace (E)	63.7	63.9	+0.2	51.1	51.2	n/a
45 Barrmill Road (N)	61.8	62.0	+0.2	49.4	49.5	n/a
45 Barrmill Road (E)	61.9	62.1	+0.2	49.4	49.6	n/a
10d Barrmill Road (NE)	60.4	60.6	+0.2	48.1	48.3	n/a
12 Barrmill Road (W)	70.6	70.8	+0.2	57.3	57.5	+0.2
12 Barrmill Road (E)	62.2	62.3	+0.1	49.7	49.8	n/a
16 Barrmill Road (SE)	55.0	55.2	+0.2	43.2	43.4	n/a
16 Barrmill Road (SW)	65.0	65.2	+0.2	52.2	52.4	n/a
2 Spiersland Way (W)	56.6	56.8	+0.2	44.7	44.9	n/a
43 Glebelands Way (SE)	69.5	69.7	+0.2	56.3	56.5	+0.2
35 Dalry Road (S)	67.4	67.5	+0.1	54.4	54.5	n/a
Manrahead Farm (S)	56.9	57.1	+0.2	44.9	45.1	n/a
Geilsland School (W)	55.6	55.8	+0.2	43.8	44.0	n/a
n/a Night time noise levels do not exceed the DMRB night time threshold of 55dB(A)						

12.8.14 Table 12.17 shows that the natural growth in traffic causes a slight increase in noise levels, however it is not perceptible at these locations. In line with the DMRB HD 213/11, the noise from traffic at night is assessed only where noise levels at night are above the interim thresholds stated by the WHO in the Night Noise Guidelines 2009 (Ref 12.4) of 55 dB $L_{night\text{-}outside}$. Night-time assessments are only undertaken at dwellings, therefore other sensitive receptors do not require to be assessed. Therefore, the properties where night-time noise levels are reported are the ones with the highest noise levels. The others do not reach the noise level of 55 dB $L_{night,outside}$. Table 12.17 identifies 18 Wardrop

Street, 11 Wardrop Terrace, 43 Glebelands Way and 12 Barrmill Road to have predicted noise levels over 55dB at night. The natural increase of traffic flow without the scheme results in a negligible magnitude of impact. This results in slight adverse impacts that are not deemed significant.

12.8.15 The long-term noise assessment for the Do-Minimum comparative is presented in Table 12.18. Figures 12.4 and 12.5 Long Term Do-Minimum comparison without mitigation for day and night illustrate the noise changes in 3 dB $L_{A10,18h}$ and in 3 dB $L_{night,outside}$ bands respectively.

Table 12.18: Long term noise impact for the Do-Minimum comparative

Do-Minimum future year 2022 – Do-Minimum baseline year 2018 (long-term)				
Change in noise level		**Daytime**		**Night-time**
		Number of dwellings	**Number of other sensitive receptors**	**Number of dwellings**
Increase in noise level $L_{A10,18h}$ $L_{night,outside}$	0.1 – 2.9	1081	9	42
	2.9 – 5.0	0	0	0
	5.0 – 9.9	0	0	0
	10+	0	0	0
No change	0	21	0	5
Decrease in noise level, $L_{A10,18h}$ $L_{night,outside}$	0.1 – 2.9	0	0	0
	2.9 – 5.0	0	0	0
	5.0 – 9.9	0	0	0
	10+	0	0	0

12.8.16 Without the scheme in place and with natural traffic increase it is expected that 1090 receptors including residential properties and community will experience an increase in noise levels between 0.1 and 2.9dB(A) and 21 residential receptors will result in no change. 42 receptors will experience a slight increase in noise levels of between 0.1 and 2.9dB(A) at night-time where levels are at or above 55 dB $L_{night,outside}$. Table 12.18 shows no areas that will experience a decrease in noise levels. In conclusion, Table 12.18 shows that there is no significant impact on the long-term Do-minimum comparison.

Long term Do-Something comparison

12.8.17 For the long term noise impacts with the Do-Something scenario, a comparison is made between the noise levels with the scheme in 2022 and the noise levels without the scheme in the baseline year, 2018 (ie Do-Something 2022 minus Do-Minimum 2018). This is considered the long term scenario without mitigation.

12.8.18 Table 12.19 shows the results at the representative receptors. Table 12.20 details the magnitude of impact for representative receptors within the study area.

12.8.19 Table 12.19 and Table 12.20 llustrate that eight of the representative receptors have perceptible impacts (ie they have changes in noise levels at least of 3dB in the long term), ranging from 12 Barrmill Road, Larch Terrace resulting in a major beneficial magnitude of impact to properties such as 16, 45 Barrmill Road and Spiersland Way resulting in moderate to major adverse magnitude of impact.

12.8.20 Presently, 16 Barrmill Road has Barrmill Road directly in front of the property where traffic idles waiting at the junction to enter the A737. With the scheme in place the noise level from traffic decreases by 0.3dB(A), however with the new alignment and the roundabout location at the back of the property the noise levels increase by 10.5dB(A).

12.8.21 The property at 45 Barrmill Road also is located adjacent to Barrmill Road and approaches the A737. As the road is moving 93m closer to the receptor, the magnitude of impact is moderate adverse for the north façade for both day and night –time scenarios. However, the east façade, which is the façade adjacent to Barrmill Road, will only experience a negligible increase.

Table 12.19: Long-term maximum noise levels at the representative receptors – without mitigation

Do-Something design year 2022 – Do-Minimum baseline year 2018 (long-term)						
Receptor	**Daytime (dB $L_{A10,18h}$)**			**Night-time (dB $L_{night,outside}$)**		
	DM 18	**DS 22**	**Change**	**DM 18**	**DS 22**	**Change**
11 Wardrop Terrace (E)	73.9	68.9	-5.0	60.2	55.7	-4.5
18 Wardrop Street (N)	69.0	67.1	-1.9	55.8	54.1	-1.7
18 Wardrop Street (S)	60.6	63.6	+3.0	48.3	51.0	n/a
24 Larch Terrace (E)	63.7	59.8	-3.9	51.1	47.6	n/a
45 Barrmill Road (N)	61.8	68.9	+7.1	49.4	55.7	+6.4

Do-Something design year 2022 – Do-Minimum baseline year 2018 (long-term)						
Receptor	**Daytime (dB $L_{A10,18h}$)**			**Night-time (dB $L_{night,outside}$)**		
	DM 18	**DS 22**	**Change**	**DM 18**	**DS 22**	**Change**
45 Barrmill Road (E)	61.9	63.3	+1.4	49.4	50.7	n/a
10d Barrmill Road (NE)	60.4	57.4	-3.0	48.1	45.4	n/a
12 Barrmill Road (W)	70.6	57.1	-13.5	57.3	45.1	-12.2
12 Barrmill Road (E)	62.2	63.8	+1.6	49.7	51.2	n/a
16 Barrmill Road (SE)	55.0	65.5	+10.5	43.2	52.7	n/a
16 Barrmill Road (SW)	65.0	64.7	-0.3	52.2	52.0	n/a
2 Spiersland Way (W)	56.6	65.2	+8.6	44.7	52.4	n/a
43 Glebelands Way (SE)	69.5	58.9	-10.6	56.3	46.7	-9.5
35 Dalry Road (S)	67.4	65.5	-1.9	54.4	52.7	n/a
Manrahead Farm (S)	56.9	56.8	+0.1	44.9	44.9	n/a
Geilsland School (W)	55.6	56.8	+1.2	43.8	44.9	n/a

Table 12.20: Magnitude of impact for representative receptors

Receptor	**Magnitude of Impact**	
	Daytime	**Night-time**
11 Wardrop Terrace (E)	Moderate beneficial	Minor beneficial
18 Wardrop Street (N)	Negligible beneficial	Negligible beneficial
18 Wardrop Street (S)	Minor adverse	n/a
24 Larch Terrace (E)	Minor beneficial	n/a
45 Barrmill Road (N)	Moderate adverse	Moderate adverse
45 Barrmill Road (E)	Negligible adverse	n/a
10d Barrmill Road (NE)	Minor beneficial	n/a
12 Barrmill Road (W)	Major beneficial	Major beneficial
12 Barrmill Road (E)	Negligible adverse	n/a
16 Barrmill Road (SE)	Major adverse	n/a
16 Barrmill Road (SW)	Negligible beneficial	n/a
2 Spiersland Way (W)	Moderate adverse	n/a
43 Glebelands Way (SE)	Major beneficial	Moderate beneficial
35 Dalry Road (S)	Negligible beneficial	n/a

Receptor	Magnitude of Impact	
	Daytime	Night-time
Manrahead Farm (S)	Negligible beneficial	n/a
Geilsland School (W)	Negligible adverse	n/a

12.8.22 The results in Table 12.21 illustrate the long term comparison of all receptors within the study area. It is shown that 8 dwellings experience significant increases for daytime (ie ≥ 3dB (A)) and one dwelling will be significant for night-time, as per the WHO Interim Target. Although dwellings have an increase in noise in the long term during the night, the $L_{night,outside}$ levels are not above 55dB.

12.8.23 Receptors at 1079 dwellings are assessed as being negligible or no change in noise levels, resulting in a negligible magnitude of impact determined for these dwellings.

12.8.24 With the scheme in place it is concluded that 15 of the dwellings are assessed as having a decrease in noise levels over 3dB which is considered perceptible. 18 dwellings where the noise levels at night are above 55 dB $L_{night,outside}$ will also have decrease over 3 dB.

12.8.25 Figures 12.6 and 12.7 Long Term Do-Something comparison without mitigation for day and night illustrates the noise changes in 3 dB $L_{A10,18h}$ and in 3 dB $L_{night,outside}$ bands respectively.

Table 12.21: Long term noise impact for the Do-Something comparative – no mitigation

Do-Something assessment year 2022 – Do-Minimum baseline year 2018 (long-term)				
Change in noise level		Daytime		Night-time
		Number of dwellings	Number of other sensitive receptors	Number of dwellings
Increase in noise level $L_{A10,18h}$ $L_{night,outside}$	0.1 – 2.9	686	5	20
	3.0 – 4.9	0	2	0
	5.0 – 9.9	5	1	0
	10+	3	0	1
No Change	0	158	0	5
Decrease in noise level, $L_{A10,18h}$	0.1 – 2.9	235	1	3
	3.0 – 4.9	9	0	3
	5.0 – 9.9	4	0	10

Do-Something assessment year 2022 – Do-Minimum baseline year 2018 (long-term)				
Change in noise level		**Daytime**		**Night-time**
		Number of dwellings	**Number of other sensitive receptors**	**Number of dwellings**
$L_{night,outside}$	10 +	2	0	5

Traffic noise and vibration nuisance

12.8.26 A summary of the changes of traffic noise annoyance experienced at residential properties from the baseline year (2018) to the future year (2022), as required by Annex 6 of the DMRB (Ref 12.1) are contained in Table 12.22. Residential receptor locations have been categorised into noise nuisance change bands as described in paragraphs 12.3.46 and12.3.47. The worst case noise levels long term have been used. The road traffic nuisance assessment considers both changes in nuisance from the 'steady-state' curve in the DMRB Figure A6.1 (which represents changes in nuisance between the Do-Something future assessment year and the Do-Minimum baseline year) and changes in nuisance from the 'before-after' curve in the DMRB Figure A6.2 (which represents changes in nuisance between the Do-Something baseline year and the Do-Minimum baseline year, but which can last enough to be considered long term impacts). However, when the change in nuisance followed the curve in the DMRB Figure A6.2 (nuisance from changes in the short term) this only has been applied when the noise level was at least 65dB $L_{A10,18h}$ that it is the range from where that curve was derived. The DMRB states that both impacts are likely to be operating, but that the first (the steady-state curve) is probably the most powerful.

Table 12.22: Traffic nuisance reporting without mitigation

Change in Traffic Noise Level (% people bothered by noise)		**Number of dwellings**	
		Do-Minimum	Do-Something
Increase in nuisance level	< 10%	628	555
	10 < 20%	0	17
	20 < 30%	0	1
	30 < 40%	0	2
	> 40%	0	4
No Change	0	474	523

Change in Traffic Noise Level		Number of dwellings	
Decrease in nuisance level	< 10%	0	0
	10 < 20%	0	0
	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0

12.8.27 Table 12.22 shows that 628 dwellings experience an increase in the level of nuisance of less than 10% in the Do-Minimum comparison with 474 resulting in no change. With the scheme in place (Do-Something comparison) the traffic noise nuisance for the majority of the dwellings are either no change or increases of less than 10% with the exception of 24 dwellings with increase above 10% of people bothered by noise.

12.8.28 The results for the representative façades at representative receptors are produced in Table 12.23 for Do-minimum 2018 versus Do-something 2022.

Table 12.23:Long-term traffic noise nuisance assessment for representative receptors without mitigation

Receptor	Change in % bothered		
	Do-Minimum	Do-Something	Change
11 Wardrop Terrace (E)	45	31	-14
18 Wardrop Street (N)	31	26	-5
18 Wardrop Street (S)	14	19	+5
24 Larch Terrace (E)	19	13	-6
45 Barrmill Road (N)	16	31	+15
45 Barrmill Road (E)	16	18	+2
10d Barrmill Road (NE)	14	10	-4
12 Barrmill Road (W)	35	10	-26
12 Barrmill Road (E)	17	19	+3
16 Barrmill Road (SE)	8	23	+15
16 Barrmill Road (SW)	22	21	-1
2 Spiersland Way (W)	9	22	+13
43 Glebelands Way (SE)	32	12	-21
35 Dalry Road (S)	27	23	-4
Manrahead Farm (S)	10	11	+0

12.8.29 Table 12.23 shows that with the scheme in place, the percentage of people bothered by traffic noise at the representative receptors have generally decreased, such as at 11 Wardrop Terrace, 10d Barrmill Road, 24 Larch Terrace and Glebelands Way.

12.8.30 Three dwellings in Table 12.23 have an increase in nuisance experienced by residents, including:

- 45 Barrmill Road (north façade)
- 16 Barrmill Road (southeast façade)
- 2 Spiersland Way (west façade)

12.8.31 There are also receptors experiencing different impacts on different façades such as 18 Wardrop Street with a decrease in nuisance on the north façade but with an increase in nuisance on the south facades (both of similar magnitude) and 12 Barrmill Road with a 26% decrease in nuisance on the west façade and a 3% increase in nuisance on the east façade.

Long-term airborne vibration nuisance assessment

12.8.32 In accordance with the DMRB HD 213/11, the airborne vibration assessment is limited to dwellings within 40m of the carriageway.

12.8.33 DMRB HD 213/11 reports that the relationship between the percentage of people bothered by largely airborne vibration and the noise exposure index is similar to that for noise nuisance except the percentage of people bothered by vibration is lower at all exposure levels. For a given level of noise exposure the percentage of people bothered very much or quite a lot by vibration is 10% lower than the corresponding figure for noise nuisance. An assessment of vibration nuisance is provided in Table 12.24. Table 12.25 provides the long term airborne vibration for the representative receptors.

12.8.34 The scheme identifies that dwellings located within the less than 10% band decrease by 133 dwellings between the long-term Do-Minimum and the long-term Do-Something comparison with five banded within 10 and 20% and one dwelling experience an increase in people bothered by airborne noise of 20-30%.

Table 12.24:Long-term traffic airborne vibration nuisance assessment without mitigation

Change in traffic airborne vibration nuisance (% people bothered by airborne noise)		Number of dwellings	
		Do Minimum	Do Something
Increase in nuisance level	< 10%	354	221
	10 < 20%	0	5
	20 < 30%	0	1
	30 < 40%	0	0
	> 40%	0	0
No Change	0	35	48
Decrease in nuisance level	< 10%	9	125
	10 < 20%	0	2
	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0

12.8.35 Table 12.25 reports the most representative façade rather than the worst-case façade as in Table 12.24 above. Nuisance from airborne vibration disappears or almost disappears from properties such as the eastern façade at 12 Barrmill Road and the south-east façade at 43 Glebelands Way. Conversely, the properties at 45 Barrmill Road, the south east façade at 16 Barrmill Road and the west façade at 2 Spiersland Way may increase the potential of having airborne vibration nuisance.

Table 12.25: Long-term traffic airborne vibration nuisance assessment for representative receptors

Receptor	Change in % bothered)		
	Do minimum	Do Something	Change
11 Wardrop Terrace (E)	35	21	-14
18 Wardrop Street (N)	21	16	-5
18 Wardrop Street (S)	4	9	+5
24 Larch Terrace (E)	9	3	-6
45 Barrmill Road (N)	6	21	+15
45 Barrmill Road (E)	6	8	+2
10d Barrmill Road (NE)	4	0	-4

Receptor	Change in % bothered)		
	Do minimum	Do Something	Change
12 Barrmill Road (W)	25	0	-25
12 Barrmill Road (E)	7	9	+3
16 Barrmill Road (SE)	0	13	+13
16 Barrmill Road (SW)	12	11	-1
2 Spiersland Way (W)	0	12	+12
43 Glebelands Way (SE)	22	2	-21
35 Dalry Road (S)	17	13	-4

Significance of impacts

Short-term noise

12.8.36 Table 12.26 illustrates the significance of impact at representative receptors with the scheme in place without mitigation in the short term ie the opening year. This scenario is comparing the Do-Something baseline year 2018 with the Do-Minimum baseline year 2018.

12.8.37 As expected, the properties with significant beneficial impacts are the ones located by the existing road whereas the properties with significant adverse impacts are the ones located closest to the scheme. There are properties such as 12 and 16 Barrmill Road where each of the façades experience impacts of different significance.

Table 12.26: Impact of the proposed scheme in the short-term at the representative receptors without mitigation

Receptor	Magnitude of Impact	Significance of Impact
11 Wardrop Terrace (E)	Major beneficial	Large beneficial
18 Wardrop Street (N)	Minor beneficial	Slight/Moderate beneficial
18 Wardrop Street (S)	Minor adverse	Slight/Moderate adverse
24 Larch Terrace (E)	Moderate beneficial	Moderate/Large beneficial
45 Barrmill Road (N)	Major adverse	Large/Very Large adverse
45 Barrmill Road (E)	Minor adverse	Slight/Moderate adverse
10d Barrmill Road (NE)	Moderate beneficial	Moderate/Large beneficial
12 Barrmill Road (W)	Major beneficial	Large/Very Large beneficial

Receptor	Magnitude of Impact	Significance of Impact
12 Barrmill Road (E)	Minor adverse	Slight/Moderate adverse
16 Barrmill Road (SE)	Major adverse	Large/Very Large adverse
16 Barrmill Road (SW)	Negligible beneficial	Slight beneficial
2 Spiersland Way (W)	Major adverse	Large/Very Large adverse
43 Glebelands Way (SE)	Major beneficial	Large/Very Large beneficial
35 Dalry Road (S)	Minor beneficial	Slight/Moderate beneficial
Manrahead Farm (S)	Negligible beneficial	Slight beneficial
Geilsland School (W)	Minor adverse	Slight/Moderate adverse

Long term noise

12.8.38 Table 12.27 illustrates the significance of impact at representative receptors with the scheme in place without mitigation in the long term, ie the design year. This scenario is comparing the Do-Something baseline year 2022 with the Do-Minimum baseline year 2018. The results follow the same trend as in the short term, however since the noise change bands are wider (a change of 1dB in the short term is equivalent to a change of 3 dB in the long term) the significance of impacts is lower in the long term compared to the short term.

Table 12.27: Impact of the proposed scheme in the long-term at the representative receptors without mitigation

Receptor	Magnitude of Impact	Significance of Impact
11 Wardrop Terrace (E)	Minor beneficial	Slight/Moderate beneficial
18 Wardrop Street (N)	Negligible beneficial	Slight beneficial
18 Wardrop Street (S)	Minor adverse	Slight/Moderate adverse
24 Larch Terrace (E)	Minor beneficial	Slight/Moderate beneficial
45 Barrmill Road (N)	Moderate adverse	Moderate/Large adverse
45 Barrmill Road (E)	Negligible adverse	Slight adverse
10d Barrmill Road (NE)	Negligible beneficial	Slight beneficial
12 Barrmill Road (W)	Major beneficial	Large/Very Large beneficial
12 Barrmill Road (E)	Negligible beneficial	Slight beneficial

Receptor	Magnitude of Impact	Significance of Impact
16 Barrmill Road (SE)	Major adverse	Large/Very Large adverse
16 Barrmill Road (SW)	Negligible beneficial	Slight beneficial
2 Spiersland Way (W)	Moderate adverse	Moderate/Large adverse
43 Glebelands Way (SE)	Major beneficial	Large/Very Large beneficial
35 Dalry Road (S)	Negligible beneficial	Slight beneficial
Manrahead Farm (S)	Negligible beneficial	Slight beneficial
Geilsland School (W)	Negligible adverse	Slight adverse

12.8.39 From the assessment it can be concluded that the receptors within Beith town, along the boundary of the existing A737, will experience a reduction in traffic noise levels with the scheme in place whilst isolated receptors particularly in the rural setting will experience increased noise levels with impacts of moderate adverse or above significance in some instances. Table 12.28 provides the level of significance for all the receptors within the study area. 11 receptors are expected to experience impacts of moderate adverse or above significance. These impacts may be consider significant and should be reduced if feasible.

Table 12.28: Summary table of the significance of impact in the long term without mitigation

Level of Significance	Number of NSRs
	High
Large/Very Large adverse	3
Moderate/Large adverse	6
Moderate adverse	0
Slight/Moderate adverse	2
Slight adverse	691
Neutral/Slight adverse	0
Neutral	158
Neutral/Slight beneficial	0
Slight beneficial	236
Slight/Moderate beneficial	9
Moderate beneficial	0
Moderate/Large beneficial	4

Level of Significance	Number of NSRs
	High
Large/Very Large beneficial	2

The Noise Insulation (Scotland) Regulations 1975

12.8.40 A first review of the properties that may qualify for noise insulation under the NISR gave a list of 15 properties: 45 Barrmill Road, 18 and 18 (G/2) Wardrop Street, Netherhill at Main Road, Stoneleigh Cottage at Dalry Road and 19 and 30 to 38 Crummock Gardens.

12.8.41 However, a careful review of the reasons why these properties may have qualified identified that for most of the properties the reason was the natural increase in traffic flows rather than the scheme itself. This was the case, for example, for all the properties at Crummock Gardens and Netherhill at Main Road which in a Do-Minimum design year would experience similar increases in noise levels to the ones in the Do-Something scenario.

12.8.42 The Land Compensation (Scotland) Act 1973 from which the NISR are developed does not intend to compensate for the intensification of traffic in existing roads but rather for schemes that cause a change in noise levels. In the area around Crummock Gardens the scheme is not causing an increase in traffic flows beyond the natural traffic growth.

12.8.43 Therefore, from professional judgement, it is considered that three properties may qualify for noise insulation. These are 45 Barrmill Road and 18 and 18 (G/2) Wardrop Street. However, the façade that would qualify for 18 and 18 (G/2) Wardrop Street is the western façade on which the properties do not have any windows and therefore they do not have any qualifying façade.

12.8.44 Consequently, only 45 Barrmill Road would qualify for noise insulation if further mitigation was not provided.

12.8.45 However, the final decision on the provision of noise insulation will need to be assessed in the first year after opening against the criteria in the NISR and Transport Scotland note STO S069 (old Instruction 2/92). Subsequent assessment will need to take place at five, ten and fifteen years after opening.

12.8.46 Nevertheless, if this property is expected to be substantially affected by construction noise, if the forecasted impacts are reasonable, insulation may be offered before construction works start.

12.9 Permanent mitigation

12.9.1 As was stated in Paragraph 12.3.48 mitigation is to be considered where the significance of impact has been determined to be "moderate adverse" or greater. Such impacts have been found to occur for the future forecast year at the following representative locations:

- 45 Barrmill Road
- 16 Barrmill Road and 16 and 18 Bells Causeway Barrmill Road (within the building at 16 Barrmill Road the OS AddressBase contains two residential receptors, one with the address 16 Barrmill Road and the other with the address 16 and 18 Bells Causeway Barrmill Road; therefore these are reported as two receptors although they just correspond to one building).
- 2 Spiersland Way
- Several buildings within the Geilsland School boundary.
- 18 and 18 (G/2) Wardrop Street (as above two addresses but one building).
- 14 Barrmill Road.

12.9.2 However, after a careful review of the results, it was found that the impacts of moderate or above significance at some of the buildings within Geilsland School boundary were on some secondary façades rather than on the façades facing the scheme. This secondary façades showed noise levels below 50dB $L_{Aeq,16h,free\text{-}field}$ (54.5 dB $L_{A10,18h,façade}$) and therefore before the threshold of moderate annoyance stated in the WHO guidelines 1999. For this reason and due to the fact that the actual noise levels in that façade may be influenced for other noise sources in addition to road traffic noise, mitigation was not considered for these secondary façades at Geilsland School boundary.

12.9.3 The moderate or above significance of impacts at the building at 18 and 18 (G/2) Wardrop Street were identified on the western façade of the building. That façade does not contain any window or does not overlook any garden and therefore mitigation was not considered for that façade either.

12.9.4 Therefore, mitigation was considered for the receptors at 45 Barrmill Road, 16 Barrmill Road (including 16 and 18 Bells Causeway) and 2 Spiersland Way. This also included the mitigation for the western façade of 14 Barrmill Road. The mitigation assessed includes low noise surfacing and the provision of noise barriers in the form of either earth bunds or vertical noise barriers.

Low Noise Surfacing

12.9.5 Quieter road surfaces such as Stone Mastic Asphalt (SMA), are likely to reduce noise levels between 2dB to 6dB$L_{A10,18h}$ compared with conventional hot rolled asphalt (HRA) surfacing. This benefit is related to the speed of the traffic on the road, and is more substantial at speeds above approximately 75km/h. At speeds above 75km/h, the TS2010 thin surfacing course provides noise reductions around -5dB(A) compared to HRA surfacing. The noise model assumes that low noise surface in accordance with TS2010 will be used along the whole scheme. In line with the procedure in DRMB, it has been assumed that this low noise surface will perform at least 70% of the performance reported. Therefore, the noise model has considered that the TS2010 thin surfacing will provide a noise reduction factor of -3.5dB(A) (ie 70% of the -5dB(A) reported). If during detailed design stage any changes are made to surface course material, further noise assessment is required to determine if the mitigation measures are sufficient.

Acoustic screens / earthworks

12.9.6 To ensure maximum attenuation, acoustic screens will be located as close as possible to the scheme, taking into account alignment requirements, land available, landscape work and visual requirements. Where sufficient land is available and a reduction in noise level is required, the acoustic screen may take the form of an earth bund, or a combination of an earth bund and a noise fence. The barrier specification will comply with all relevant British Standards.

12.9.7 The earth bunds and barriers are proposed along the A737, on both sides of the carriageway in order to mitigate the noise levels of the A737 where it bisects 45 and 16 Barrmill Road. An earth bund is also proposed at the junction of Wardrop Street running southbound along the new aligned A737. This will help screen the A737 for the properties at 18/20 Wardrop Street. The locations and height of the acoustic screens (earth bunds and barriers) are detailed as follows and illustrated within Figure 12.8 to Figure 12.10.

- Earth bund at Wardrop Street – starts at Chainage 450 to 480, at a height of 1.5m at a 1 in 3 slope.
- Southbound direction travelling from Barrmill Road
    - An earth bund starts at Chainage 925 to 980 at a maximum height of 2.5m.

- A retaining wall and noise barrier 2.5m in height will run from Chainage 980 to Chainage 1085 where it will overlap with the earth bund which will taper back up to 2.5m at Chainage 1085.
- From Chainage 1185 to 1180 the earth bund will remain at a constant height of 2.5m. At Chainage 1180 the earth bund will taper down to 1.5m to Chainage 1200. From Chainage 1200 to 1280 the earth bund will remain at a constant height of 1.5m, whilst tapering down to ground level at Chainage 1280 to 1300.

- Northbound direction from Manrahead roundabout
  - At Chainage 1120 to 1040 a 2.5m barrier at a height 2.5m will run where it overlaps with retaining wall at Chainage 1040 (approximately 1m in height, at road level) with a 2.5m barrier on top to Chainage 950.
  - An earth bund tapers up from a height of zero at Chainage 950 up to full height of approximately 3.5m above roundabout level. The earth bund starts at Chainage 950 along the new A737 and ends Chainage 80 along Barrmill Road West route.

12.9.8 The side slopes of the bunds will depend on the type and quality of the material available to construct them with. As this information is not available at this time, they are assumed to have 1:3 side slopes.

12.9.9 Noise mitigation will be finalised during detailed design in accordance with the DMRB Volume 10, Barrier Framework Assessment (Ref 12.29). The earth bunds are integrated into the landscape design.

12.10 Permanent residual impacts

Noise and vibration assessment – short-term

12.10.1 With mitigation in place the noise model was recalculated and the results of the representative receptors are detailed within Table 12.29 for short term impacts and Table 12.30 for the overall assessment results for the study area. Table 12.30 identifies the receptors that show different magnitude of impact without and with mitigation in place.

Table 12.29: Short-term (opening year) noise levels at the representative receptors–with mitigation

Do-Something baseline year 2018 – Do-Minimum baseline year 2018 (short-term)				
Receptor (ID)	**DM 18 (dB $L_{A10,18h}$)**	**DS 18 (dB $L_{A10,18h}$)**	**Change in noise (dB $L_{A10,18h}$)**	**Magnitude of Impact**
11 Wardrop Terrace (E)	73.9	68.7	-5.2	Major beneficial
18 Wardrop Street (N)	69.0	66.8	-2.2	Minor beneficial
18 Wardrop Street (S)	60.6	63.3	+2.7	Minor adverse
24 Larch Terrace (E)	63.7	59.6	-4.1	Moderate beneficial
45 Barrmill Road (N)	61.8	58.5	-3.3	Moderate beneficial
45 Barrmill Road (E)	61.9	56.3	-5.6	Major beneficial
10d Barrmill Road (NE)	60.4	56.8	-3.6	Moderate beneficial
12 Barrmill Road (W)	70.6	54.2	-16.4	Major beneficial
12 Barrmill Road (E)	62.2	60.1	-2.1	Minor beneficial
16 Barrmill Road (SE)	55.0	59.0	+4.0	Moderate adverse
16 Barrmill Road (SW)	65.0	56.5	-8.5	Major beneficial
2 Spiersland Way (W)	56.6	54.8	-1.8	Minor beneficial
43 Glebelands Way (SE)	69.5	57.8	-11.7	Major beneficial
35 Dalry Road (S)	67.4	65.4	-2.0	Minor beneficial
Manrahead Farm (S)	58.1	58.0	-0.1	Negligible beneficial
Geilsland School (W)	55.6	57.2	+1.6	Minor adverse

Table 12.30: Short-term noise impact assessment – with mitigation

Do-Something baseline year 2018 – Do-Minimum baseline year 2018 (short-term)			
Change in noise level		**Daytime**	
		Number of dwellings	**Number of other sensitive receptors**
Increase in noise level $L_{A10,18h}$ $L_{night,outside}$	0.1 – 0.9	442	4
	1.0 – 2.9	24	3
	3.0 – 4.9	3	1

Do-Something baseline year 2018 – Do-Minimum baseline year 2018 (short-term)			
Change in noise level		**Daytime**	
		Number of dwellings	**Number of other sensitive receptors**
	5+	0	0
No Change	0	200	0
Decrease in noise level, $L_{A10,18h}$ $L_{night,outside}$	0.1 – 0.9	298	0
	1.0 – 2.9	114	1
	3.0 – 4.9	14	0
	5+	7	0

12.10.2 As noted, for the scheme in the opening year the mitigation is effective in reducing impacts for the following properties:

12.10.3 45 Barrmill Road – the Do-Minimum noise level for 2018 is 61.8dB at the north façade and with the scheme without mitigation this increased to 68.6dB(A), which is an increase in 6.8dB(A). However, with the low noise surface and the noise barrier at a height of 2.5m the noise level is 58.5dB(A) which is a 3.3dB(A) reduction compare to the Do-Minimum. This results in a reduction of 10.1dB with mitigation in place.

- 12 Barrmill Road – the Do-Minimum noise level for 2018 is 62.2dB at the east façade which looks out to the scheme. With the scheme in place the noise levels at the east façade increase to 63.7 dB(A) which is an increase of 1.5dB(A). With mitigation in place the noise levels are reduced to 60.1dB(A), which is a reduction of 2.1dB(A) compared to the Do-Minimum scenario and of 3.6dB(A) compared to the Do-Something unmitigated scenario.

- 16 Barrmill Road – the Do-Minimum noise level at the southwest façade which looks out to Barrmill Road and the A737 is 65.0dB. With the scheme in place the noise level decreases by 0.7dB(A) to 64.3dB(A) and after the provision of mitigation the noise level decreases by 8.5 dB(A) to 56.5dB(A). The southeast façade which looks out the new scheme and roundabout has a Do-minimum noise level of 55.0dB which increases by 10.2dB(A) to 65.2d(A) with the scheme without mitigation. However, after the provision of mitigation, the noise level increases by 4.0dB(A) to 59.0dB(A). Therefore, mitigation reduces the noise level at the southeast façade by 6.2dB(A) compared to the unmitigated scenario. Nevertheless, after mitigation, the southeast façade still shows an impact of moderate adverse magnitude in the short term which corresponds to an impact significance of moderate/large adverse.
- 2 Spiersland Way - the Do-Minimum noise level is 56.6dB and with the scheme but without mitigation this results with an increase in noise levels by 8.3dB(A) to 64.9dB(A). After the provision of mitigation, there is a reduction in noise levels compared to the Do-Minimum by 1.8dB(A) to 54.8dB(A). Therefore, after the provision of mitigation, the magnitude of impact in the short term is minor beneficial which results in an impact significance of slight/moderate beneficial.
- 18 Wardrop Street – the north façade will experience a reduction in noise levels with the road moving slightly away from the existing alignment. Do-Minimum noise levels of 69.0dB(A) reduce to 66.8dB(A) with the scheme. Whereas, the south façade will experience an increase in noise levels from 60.6dB(A) to 63.3dB(A) with the A737 alignment moving closer when the scheme is in place. This increase of 2.7dB(A) represents a magnitude of impact of minor adverse that results in an impact significance of slight/moderate.

12.10.4 Figure 12.8 illustrates the contour levels that represent the changes in noise levels in the short-term, ie the changes in noise between the Do-Minimum opening year and the Do-Something opening year with mitigation.

Noise and vibration assessment – long-term

12.10.5 Table 12.31 and Table 12.32 show the impacts of the scheme with the proposed mitigation in the long term. The mitigation reduces the impacts at 2 Spiersland Way and 45 Barrmill Road and to a lesser degree at 12 and 16 Barrmill Road.

Table 12.31: Long-term maximum noise levels at the representative receptors – with mitigation

Do-Something design year 2022 – Do-Minimum baseline year 2018 (long-term)						
Receptor	**Daytime (dB $L_{A10,18h}$)**			**Night-time ($L_{night,outside}$)**		
	DM18	**DS22**	**Change**	**DM18**	**DS22**	**Change**
11 Wardrop Terrace (E)	73.9	68.9	-5.0	60.3	55.7	-4.5
18 Wardrop Street (N)	69.0	67.0	-2.0	55.9	54.0	-1.8
18 Wardrop Street (S)	60.6	63.5	+2.9	48.5	50.9	n/a
24 Larch Terrace (E)	63.7	59.7	-4.0	51.2	47.5	n/a
45 Barrmill Road (N)	61.8	58.7	-3.1	49.5	46.6	n/a
45 Barrmill Road (E)	61.9	56.5	-5.4	49.6	44.6	n/a
10d Barrmill Road (NE)	60.4	56.8	-3.6	48.3	44.9	n/a
12 Barrmill Road (E)	70.6	54.2	-16.4	57.5	42.5	-14.8
14 Barrmill Road (E)	62.2	60.0	-2.2	49.8	47.7	n/a
16 Barrmill Road (SE)	55.0	59.3	+4.3	43.4	47.1	n/a
16 Barrmill Road (SW)	65.0	56.9	-8.1	52.4	44.9	n/a
2 Spiersland Way (W)	56.6	55.1	-1.5	44.9	43.3	n/a
43 Glebelands Way (SE)	69.5	57.9	-11.6	56.5	45.8	-10.4
33 Dalry Road (S)	67.4	65.6	-1.8	54.5	52.8	n/a
Manrahead Farm (S)	58.1	58.2	+0.1	46.2	46.1	n/a
Geilsland School 8669, (W)	55.6	57.2	+1.6	43.8	45.2	n/a

12.10.6 Table 12.32 shows that the scheme with mitigation has an adverse magnitude of impact (ie a perceptible change) at 4 properties during daytime and at no properties during night-time. Conversely, the scheme with mitigation has a perceptible beneficial magnitude of impact at 18 properties during daytime and at 18 properties during night-time. The significance of these perceptible changes is discussed in the section 'Significance of Impact' below.

Table 12.32: Long term noise impact for the Do-Something comparative with mitigation

Do-Something design year 2022 – Do-Minimum baseline year 2018 (long-term)				
Change in noise level		**Daytime**		**Night-time**
		Number of dwellings	**Number of other sensitive receptors**	**Number of dwellings**
Increase in noise level $L_{A10,18h}$ $L_{night,outside}$	0.1 – 0.9	610	7	20
	1.0 – 2.9	3	1	0
	3.0 – 4.9	0	0	0
	5+	0	0	0
No Change	0	183	0	5
Decrease in noise level, $L_{A10,18h}$ $L_{night,outside}$	0.1 – 0.9	288	1	3
	1.0 – 2.9	11	0	3
	3.0 – 4.9	5	0	7
	5+	2	0	8

Traffic noise and vibration nuisance

12.10.7 Table 12.33 compares the traffic noise nuisance between the Do-Minimum comparison and the Do-Something comparison. Comparing these results with the results without mitigation in place in Table 12.22 above, it can be seen that the increase in nuisance in the long term Do-Something will be lower than in the long term Do-Minimum.

Table 12.33: Traffic nuisance reporting with mitigation

Change in traffic nuisance (% people bothered by noise)		**Number of dwellings**	
		Do Minimum	**Do Something**
Increase in nuisance level	< 10%	656	456
	10 < 20%	0	17
	20 < 30%	0	1
	30 < 40%	0	2
	> 40%	0	0
No Change	0	446	626
Decrease in nuisance	< 10%	0	0
	10 < 20%	0	0

Change in traffic nuisance (% people bothered by noise)		Number of dwellings	
		Do Minimum	Do Something
level	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0

12.10.8 Table 12.34 shows the detail of the traffic nuisance assessment at the representative receptors. With mitigation in place almost all the representative receptors show either decreases or very small increases in the percentage of people that would be annoyed by traffic noise. Looking at the detail of 18 Wardrop Street and 16 Barrmill Road, it is important to highlight that although there are increases in the percentage of people bothered by noise on the south and southeast façade respectively (+5% in both cases), the actual percentage or people bothered by noise in the Do-Something future assessment year is similar in both façades. Thus, the percentage of people bothered by road traffic noise in the north façade at 18 Wardrop Street is 26% in the Do-Something (that is a reduction of -5%) for 19% at the south façade (that is an increase of +5%). In the same line, the percentage of people bothered by road traffic noise on the southeast façade at 16 Barmill Road is 13% (that is an increase of +5%) for 10% on the southwest façade (that is a reduction of 12%).

Table 12.34: Long-term traffic noise nuisance assessment for representative receptors – with mitigation

Receptor	(Change in % people bothered)		
	Do-minimum	Do-Something	Change
11 Wardrop Terrace (E)	45	31	-14
18 Wardrop Street (N)	31	26	-5
18 Wardrop Street (S)	14	19	+5
24 Larch Terrace (E)	19	13	-6
45 Barrmill Road (N)	16	12	-4
45 Barrmill Road (E)	16	9	-7
10d Barrmill Road (NE)	14	9	-4
12 Barrmill Road (W)	35	7	-28
12 Barrmill Road (E)	17	13	-3
16 Barrmill Road (SE)	8	13	+5
16 Barrmill Road (SW)	22	10	-12

Receptor	(Change in % people bothered)		
2 Spiersland Way (W)	9	8	-1
43 Glebelands Way (SE)	32	11	-22
35 Dalry Road (S)	27	23	-4
Manrahead Farm (S)	11	11	+0

12.10.9 Table 12.35 shows the potential nuisance due to airborne vibration with the Do-Something with mitigation in place. When compared to the results in Table 12.24 above, mitigation results in a decrease in the number of properties potentially showing increased traffic airborne vibration (from 227 without mitigation to 211 with mitigation).

Table 12.35:Long-term traffic airborne vibration nuisance assessment with mitigation

Change in traffic airborne vibration nuisance (% people bothered by airborne noise)		Number of dwellings	
		Do Minimum	Do Something
Increase in nuisance level	< 10%	354	209
	10 < 20%	0	2
	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0
No Change	0	35	55
Decrease in nuisance level	< 10%	9	133
	10 < 20%	0	2
	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0

Significance of impacts

Comparison of long term and short term with mitigation

12.10.10 Table 12.36 below shows the comparison of the significance of impacts with mitigation between the short term and the long term. With mitigation, the significance of impact at the area of 45 Barrmill Road becomes beneficial. Thus, the only properties where significant adverse impacts remain are 16 Barrmill Road (including 16 and 18 Bells

Causeway within the same building) and 18 Wardrop Street (including 18 (G/2) Wardrop Street within the same building). However, in all 'four' cases one of the façades of each of the properties have adverse impacts (ie southeast façade at 16 Barrmill Road and south façade at 18) Wardrop Street) whereas the other façades have beneficial impacts (ie southwest façade at 16 Barrmill Road and north façade at 18 and 18 (G/2) Wardrop Street).

12.10.11 At 16 Barrmill Road (including 16 and 18 Bells Causeway), noise levels are expected to be around 61 dB $L_{A10,18h}$ at the south west façade (a reduction of around 5 dB compared to the existing situation) and a noise level of around 63 dB $L_{A10,18h}$ at the south east façade (an increase of around 7 dB compared to the existing situation). Therefore these properties will see their noise levels increased at their currently quietest façade and reduced at their currently noisiest façade. This may cause some change in behaviour in those properties and the significance of impact it is likely to be significant adverse which is defined as a significance of impact of moderate adverse of above. The southeast façade shows a significance of impact of moderate/large adverse in the short term which becomes slight/moderate adverse in the long term.

12.10.12 The property at 18 Wardrop Street (including 18 (G/2) Wardrop Street) will experience similar changes, with decreases at their currently noisiest façade (from around 69 dB $L_{A10,18h}$ to around 67 dB $L_{A10,18h}$) and increases at their currently quietest façade (from around 61 dB $L_{A10,18h}$ to around 64 dB $L_{A10,18h}$). As noted previously, this may cause some change in behaviour in those properties and the impact it is likely to be significant adverse (slight/moderate adverse) in the short term. However, in the long term the significance of impact would become slight adverse which is not considered to be significant.

12.10.13 The mitigation of significant impacts reduces the noise levels at the moderate or above adverse impacts as far as reasonable practicable such that they do not exceed the NISR eligibility criteria. Therefore with the mitigation in place, the only property that was considered to qualify for noise insulation (ie 45 Barrmill Road), would not qualify anymore.

Table 12.36: Proposed scheme significance of impact for 2018 and 2022 mitigated levels with the scheme (dB $L_{A10, 18h}$)

Receptor	2018 (Mitigated)		2022 (Mitigated)		Magnitude of impact		Significance of Impact	
	DM18	DS18	DM18	DS22	ST	LT	ST	LT
11 Wardrop Terrace (E)	73.9	68.7	73.9	68.9	Major beneficial	Moderate beneficial	Large/Very Large beneficial	Moderate/Large beneficial
18 Wardrop Street (N)	69.0	66.8	69.0	67.0	Minor beneficial	Negligible beneficial	Slight/Moderate beneficial	Slight beneficial
18 Wardrop Street (S)	60.6	63.3	60.6	63.5	Minor adverse	Negligible adverse	Slight/Moderate adverse	Slight adverse
24 Larch Terrace (E)	63.7	59.6	63.7	59.7	Moderate beneficial	Minor beneficial	Moderate/Large beneficial	Slight/Moderate beneficial
45 Barrmill Road (N)	61.8	58.5	61.8	58.7	Moderate beneficial	Minor beneficial	Moderate/Large beneficial	Slight/Moderate beneficial
45 Barrmill Road (E)	61.9	56.3	61.9	56.5	Major beneficial	Moderate beneficial	Large/Very Large beneficial	Moderate/Large beneficial
10d Barrmill Road (NE)	60.4	56.8	60.4	56.8	Moderate beneficial	Minor beneficial	Moderate/Large beneficial	Slight/Moderate beneficial
12 Barrmill Road (W)	70.6	54.2	70.6	54.2	Major beneficial	Major beneficial	Large/Very Large beneficial	Large/Very Large beneficial
12 Barrmill Road (E)	62.2	60.1	62.2	60.0	Minor beneficial	Negligible beneficial	Slight/Moderate beneficial	Slight beneficial

Receptor	2018 (Mitigated)		2022 (Mitigated)		Magnitude of impact		Significance of Impact	
	DM18	DS18	DM18	DS22	ST	LT	ST	LT
16 Barrmill Road (SE)	55.0	59.0	55.0	59.3	Moderate adverse	Minor adverse	Moderate/Large adverse	Slight/Moderate adverse
16 Barrmill Road (SW)	65.0	56.5	65.0	56.9	Major beneficial	Moderate beneficial	Large/Very Large beneficial	Moderate/Large beneficial
2 Spiersland Way (W)	56.6	54.8	56.6	55.1	Minor beneficial	Negligible beneficial	Slight/Moderate beneficial	Slight beneficial
43 Glebelands Way (SE)	69.5	57.8	69.5	57.9	Major beneficial	Major beneficial	Large/Very Large beneficial	Large/Very Large beneficial
35 Dalry Road (S)	67.4	65.4	67.4	65.6	Minor beneficial	Negligible beneficial	Slight/Moderate beneficial	Slight beneficial
Manrahead Farm (S)	58.1	58.0	58.1	58.2	Negligible beneficial	Negligible adverse	Slight beneficial	Slight adverse
Geilsland School (W)	55.6	56.7	55.6	56.8	Minor adverse	Negligible adverse	Slight/Moderate adverse	Slight adverse

Comparison of the scenarios with and without mitigation

12.10.14 The table above showed the change between the short term and the long term comparisons with the Do-Something scenarios with mitigation. To better understand the impact of the mitigation on the significance of impacts, Table 12.37 shows the result of the mitigation measures (earth bunds, vertical noise barriers and low noise surface) on the significance of impact at representative receptors. The implementation of mitigation measures results in an improvement of the significance of impact in all the representative receptors where the unmitigated scenarios show adverse impacts. Therefore, this demonstrates the adequacy of the mitigation measures implemented.

Table 12.37: Result of the mitigation measures at representative receptors

Receptor	Significance of impact in the short term			Significance of impact in the long term		
	Unmitigated	**Mitigated**	**Result**	**Unmitigated**	**Mitigated**	**Result**
11 Wardrop Terrace (E)	Large/Very Large beneficial	Large/Very Large beneficial	Neutral	Slight/Moderate beneficial	Moderate/Large beneficial	Improvement
18 Wardrop Street (N)	Slight/Moderate beneficial	Slight/Moderate beneficial	Neutral	Slight beneficial	Slight beneficial	Neutral
18 Wardrop Street (S)	Slight/Moderate adverse	Slight/Moderate adverse	Neutral	Slight/Moderate adverse	Slight adverse	Improvement
24 Larch Terrace (E)	Moderate/Large beneficial	Moderate/Large beneficial	Neutral	Slight/Moderate beneficial	Slight/Moderate beneficial	Neutral
45 Barrmill Road (N)	Large/Very Large adverse	Moderate/Large beneficial	Improvement	Moderate/Large adverse	Slight/Moderate beneficial	Improvement
45 Barrmill Road (E)	Slight/Moderate adverse	Large/Very Large beneficial	Improvement	Slight adverse	Moderate/Large beneficial	Improvement
10d Barrmill Road (NE)	Moderate/Large beneficial	Moderate/Large beneficial	Neutral	Slight beneficial	Slight/Moderate beneficial	Improvement
12 Barrmill Road (W)	Large/Very Large beneficial	Large/Very Large beneficial	Neutral	Large/Very Large beneficial	Large/Very Large beneficial	Neutral
12 Barrmill Road (E)	Slight/Moderate adverse	Slight/Moderate beneficial	Improvement	Slight beneficial	Slight beneficial	Neutral
16 Barrmill	Large/Very Large	Moderate/Large	Improvement	Large/Very Large	Slight/Moderate	Improvement

Receptor	Significance of impact in the short term			Significance of impact in the long term		
	Unmitigated	**Mitigated**	**Result**	**Unmitigated**	**Mitigated**	**Result**
Road (SE)	adverse	adverse		adverse	adverse	
16 Barrmill Road (SW)	Slight beneficial	Large/Very Large beneficial	Improvement	Slight beneficial	Moderate/Large beneficial	Improvement
2 Spiersland Way (W)	Large/Very Large adverse	Slight/Moderate beneficial	Improvement	Moderate/Large adverse	Slight beneficial	Improvement
43 Glebelands Way (SE)	Large/Very Large beneficial	Large/Very Large beneficial	Neutral	Large/Very Large beneficial	Large/Very Large beneficial	Neutral
35 Dalry Road (S)	Slight/Moderate beneficial	Slight/Moderate beneficial	Neutral	Slight beneficial	Slight beneficial	Neutral
Manrahead Farm (S)	Slight beneficial	Slight beneficial	Neutral	Slight adverse	Slight adverse	Neutral

Significance of impacts in the long term

12.10.15 As stated in the TAN 2011, where the overall impact in the long term is expected to be 'moderate adverse' or greater, the impact is considered significant. Therefore, as best practice, mitigation should be implemented, where practicable, where the significance of impact in the long term is expected to be 'moderate adverse' or worse. As stated in the TAN 2011, moderate adverse impacts while important are not likely to be key decision making issues. At the same time slight adverse impacts are unlikely to be of importance in the decision making process. As stated in the TAN 2011, moderate adverse impacts while important are not likely to be key decision making issues. At the same time slight adverse impacts are unlikely to be of importance in the decision making process. Since the four cases reported above are slight/moderate adverse impacts but when put in context they are more similar to slight adverse impacts, it is considered that the scheme avoids significant adverse impacts.

12.10.16 Table 12.38 summarises the significance of impact in the long term. The final design with mitigation avoids moderate adverse impacts at all the façades of all the properties but four.

Table 12.38: Summary table of the significance of impact in the long term

Level of Significance	Number of NSRs
	High
Large/Very Large adverse	0
Moderate/Large adverse	0
Moderate adverse	0
Slight/Moderate adverse	4
Slight adverse	617
Neutral/Slight adverse	0
Neutral	183
Neutral/Slight beneficial	0
Slight beneficial	289
Slight/Moderate beneficial	11
Moderate beneficial	0
Moderate/Large beneficial	5
Large/Very Large beneficial	2

12.10.17 Of these four façades, two are within buildings at the Geilsland School complex. However, looking at the results in detail, the noise changes in those facades are just in the boundary between slight adverse and slight/moderate adverse impacts and the noise levels are below the 50dB $L_{Aeq,16h}$ from the WHO guidelines for moderate annoyance. For example, the church building (named Crammond in the OS Address database) shows negligible increases (corresponding to slight impacts) of around 2dB $L_{A10,18h}$ in the western façade (facing the scheme) with noise levels around 55dB $L_{A10,18h}$ (ie around 51dB $L_{Aeq,16h}$ free-field used in the WHO guidelines). However, the façade with the highest increase (around 3dB $L_{A10,18h}$) is one of the eastern façades where the noise level in the long term is expected to be 49.4dB $L_{A10,18h}$ (ie 44.9dB $L_{Aeq,16h}$) well below the threshold of annoyance from the WHO guidelines.

12.10.18 The other two receptors with potentially slight/moderate adverse impacts correspond to the south-east façade of the building at 16 Barrmill Road (ie one building but two addresses registered in that building: 16 Barrmill Road and 16 18 Bells Causeway Barmill Road). However, looking at the results in detail, the building shows very different impacts depending on the façade ranging from large/very large beneficial significance of impact at the north-west façade to slight/moderate adverse significance of impact at the south-east façade.

12.10.19 As stated in the TAN 2011, moderate adverse impacts while important are not likely to be key decision making issues. At the same time slight adverse impacts are unlikely to be of importance in the decision making process. Since the four cases reported above are slight/moderate adverse impacts but when put in context they are more similar to slight adverse impacts, it is considered that the scheme avoids significant adverse impacts.

12.11 Statutory and planning context

12.11.1 The following legislation, plans and policies were identified as being applicable to the scheme. Table 12.39 provides the descriptions for each, demonstrates their relevance to the scheme, and indicates whether the scheme achieves the objectives of each.

Table 12.39: Statutory and planning context

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
Legislation			
Environmental Protection Act 1990 (as amended)	Since 1 April 1996, by virtue of the Environment Act 1995 (Ref 12.7), the Environmental Protection Act 1990 (Ref 12.5) has given Scottish Local Authorities considerable and wide-ranging powers to tackle noise nuisance. Section 79 of the 1990 Act imposes a duty on local authorities to take reasonable steps to investigate complaints of nuisance and to inspect their area from time to time to detect statutory noise nuisances. Part III of the EPA 1990 all local authorities have a duty to investigated noise complaints arising from premises and construction vehicles and plant during period of work.	During construction to control noise levels and measures in place to ensure best practicable means are adhered to reduce the likelihood of complaints. North Ayrshire Council have been consulted and agreed measures, periods of work etc. Refer to Appendix 5.1: Consultation. Any changes to timings of construction works will be agreed with the Local Authority.	Yes
Control of Pollution Act 1974 (as amended)	The Control of Pollution Act 1974 (Ref 12.6) was largely repealed by the Environmental Protection Act 1990. However, sections that are extant give local authorities powers to control noise from construction sites. Section 61 of this act sets out procedures for those undertaking works to obtain a "prior consent for	Construction noise will be an issue throughout the development of the new carriageway. Properties such as 12, 14, 16, 45 Barrmill Road, 2 Spiersland Way will experience the most increase in noise levels during	Yes

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	construction works within agreed noise limits.	construction. If a section 61 consent is required then this will be undertaken and put in place via the contractor.	
Noise and Statutory Nuisance Act 1993 (as amended)	The Noise and Statutory Nuisance Act 1993 (as amended) makes links to Section 79 of the Environmental Protection Act 1990 in that noise that is prejudicial to health or a nuisance and is emitted from or caused by a vehicle, machinery or equipment in a street is classed as a statutory nuisance.	Construction activities are within 50m at some receptors, therefore mitigation measures will be in place as per BS 5228 in order to minimise impacts of the scheme to nearby receptors.	Yes
Environmental Noise (Scotland) Regulations 2006	The Environmental Noise (Scotland) Regulations 2006 were introduced into Scotland to implement the Assessment and Management of Environmental Noise Directive 2002/49/EC. This Directive relates to the assessment and management of environmental noise in EU member states and states the existence of Strategic Noise Maps and Noise Action Plans that might need to be taken into account during the assessment of road projects. Sets out requirements on competent authorities to undertake strategic noise mapping of major roads and	The improvements along the A737 at Beith are not within a Noise Candidate Area. Therefore, no further consideration is required.	N/A

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	then create actions plans.		
Noise Insulation (Scotland) Regulations 1975	The regulations impose a duty (Regulation 3) or confer powers (Regulation 4) on the relevant authority under Part II of the Land Compensation (Scotland) Act 1973 to provide, or make a grant towards, installation of noise insulation at eligible properties affected by new roads or an altered road. The regulations refer specifically to residential properties within 300 m of the new and altered road, and the noise level reaches or exceeds 68 dB $L_{A10,18h}$ with at least 1dB(A) resulting from the increase in traffic. Regulation 5 of the NISR provides relevant authorities with discretionary powers to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings with respect to construction noise.	To identify properties within the study area that are eligible for insulation measures as per the Noise Insulation (Scotland) Regulations 1975.	Yes
Policies			
The Planning Advice Note 1/2011 'Planning and	This Planning Advice Note provides advice on the role of the planning system in helping to prevent and limit the adverse impacts of noise. The PAN promotes the principles of good acoustic	The proposed road design directly runs through two residential properties within a rural setting. The guidance helps to promote any	Yes

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
Noise' (PAN 1/2011)	design and a sensitive approach to the location of new development. It promotes the appropriate location of new potentially noisy development, and a pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected and that new development continues to support sustainable economic growth.	mitigation measures in either altering the design or providing barrier methods to reduce noise levels. Low noise surface and noise barriers in the form of earth bunds and vertical barriers reduce the adverse impacts at 16 Barrmill Road and convert in beneficial the impacts at 45 Barrmill Road.	
North Ayrshire Council Local Development Plan 2014	Chapter 6 of the Local Development Plan Environmental Adoption Statement refers to the topic of "Providing Infrastructure" (Ref 12.15). Although the definition of infrastructure given in that document exceeds the definition of a road, it states that new development would have to: Identify and promote opportunities to reduce noise and light pollution. General Policy Part (a) of the General Policy Siting, Design and External Appearance. This is a policy that any development should have regard to the relationship of the development with visual and	In general the scheme will have a positive impact due to the existing A737 moving further away from residential receptors within the study area in particular the town of Beith. However, scattered receptors including 45 and 16 Barrmill Road may experience an adverse impact due to the road moving directly in front of these properties. As part of the assessment mitigation measures will be provided to	Yes

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	landscape impacts. Ensuring that the design is unique to the rural setting.	reduce the impacts.	
North Ayrshire Council Draft Local Transport Strategy 2015-2020	The North Ayrshire Council Draft Local Transport Strategy's key priorities are: • Economic growth • Improving accessibility and connectivity to help reduce inequality • Reducing the negative impacts of transport on communities, businesses, and the environment Policy EN 9 – Ensure the development of any transport infrastructure minimises the environmental impact and seeks to deliver positive environmental benefits in line with environmental mitigation and enhancement. This policy is relating to reduction of traffic congestion. Noise from a new or altered road is considered to be an impact to sensitive receptors.	Traffic noise impacts are anticipated at isolated receptors including 16 and 45 Barrmill Road. The assessment will provide mitigation measures to reduce the impacts of the traffic noise.	Yes

Assumptions and Limitations

12.11.2 Noise levels are predicted from traffic models. Therefore, there is an uncertainty that applies to forecasts of traffic flows, % HGVs and average speed which can affect the predicted noise levels.

12.11.3 The traffic base model was created at Stage 2 using a comprehensive data set specifically for the scheme in October 2013 and calibrated and validated against the criteria outlined in the DMRB Volume 12. Moving forward to the Stage 3 DMRB assessment, the model was validated using ATC count data at Transport Scotland permanent counter site JTC00084 located at Roebank Road.

12.11.4 The height of each of the buildings was assumed to be 8m high since no detailed information was available.

12.11.5 Limited information is available in terms of construction methods and plant, therefore the quantitative assessment is based on generic assumptions.

12.11.6 At this stage, it is not known if blasting of the rock at Barrmill Road will be required as part of the earthworks and it has not been considered. Therefore, if rock blasting was required, the construction noise assessment will need to be updated accordingly.

12.12 Conclusion

Construction

12.12.1 During construction it is anticipated that the increase in the noise levels will be unavoidable for isolated receptors within the study area such as properties at Head Street/Wardrop Street Junction, Manrahead Roundabout, and 16 and 45 Barrmill Road. However, during such times the contractor shall provide a proactive approach to liaise with the community at all times and implement an appropriate mitigation strategy by using best practice means to minimise construction impacts. Construction impacts are considered temporary in nature lasting for 12 months. Mitigation measures will be incorporated into the Construction Environmental Management Plan in line with the Construction Code of Practice to ensure that these impacts are kept to a minimum.

12.12.2 The above measures should avoid the need for provision of noise insulation to the closest properties to the construction works. However, noise insulation may be considered at some specific properties if necessary.

12.12.3 Considering the mitigation measures stated above and the fact that construction noise is assumed to be limited to daytime works, it is still concluded that the construction impacts will be significant, in particular for those residential receptors closest to the works.

12.12.4 At this stage, it is not known if blasting of the rock at Barrmill Road will be required as part of the earthworks and it has not been considered. Therefore, if rock blasting is required, the construction noise assessment will need to be updated accordingly.

Operation

12.12.5 The scheme will reduce the number of properties where people are annoyed by traffic noise. Primarily this reduction will be in the area of the properties close to the existing road (see Figure 12.8 for the short term and Figures 12.9 and 12.10 for the long term daytime and night-time respectively). Conversely, a few scattered properties to the east of the existing road will show significant adverse impacts unless further mitigation is provided namely 45 Barrmill Road and 2 Spiersland Way, 16 Barrmill Road (including 16 18 Bells Causeway) and 18 Wardrop Street (including 18 (G/2) Wardrop Street.

12.12.6 With further mitigation, the impacts at the area of 45 Barrmill Road and 2 Spiersland Way become beneficial. The impacts at 16 Barrmill Road are different depending on the façades, with decreases at the façade facing the existing road and increases at the façade facing the scheme. The provision of mitigation achieved a reduction on the significance of impact in the long term at the southeast façade of 16 Barrmill Road from large/very large adverse to slight/moderate adverse. Therefore, with mitigation in place, the significance of impacts at the southeast façade of 16 Barrmill Road is expected to be slight/moderate adverse in the long term. Moderate adverse impacts or above are considered significant. However, the TAN 2011 states that impacts of moderate adverse significance, while important, are not likely to be key decision making issues considered. Moreover, it is considered that the mitigation provided (low noise surface and noise barriers) reduces the noise levels at the southeast façade as far as practicable. Finally, the impacts at 18 and 18 (G/2) Wardrop Street also differ depending on the façade. The north façade shows beneficial impacts, however the south façade shows an impact of slight adverse significance which is not considered significant.

13 Effects on all Travellers

13.1 Introduction

13.1.1 This chapter considers the impacts arising from the construction and operation of the scheme on all travellers. The term all travellers, refers to people travelling by motorised vehicle, travelling on foot as well as by bicycle and on horseback.

13.1.2 The assessment has been carried out as per Interim Advice Note 125/09 (Ref 13.1), which combines the pedestrians, cyclists and equestrians sections of the DMRB Volume 11, Section 3, Part 8 (Ref 13.2) with the vehicle travellers section of the DMRB Volume 11, Section 3, Part 9 (Ref 13.3). The same IAN also suggests that the community effects section of Part 8 should instead be added to the DMRB Volume 11, Section 3, Part 6 (Ref 13.4) in order to produce a Community and Private Assets chapter (Chapter 14). DMRB Volume11, Section 3, Part 8 considers community effects in relation to how changes in journey times and amenity could affect the separation of community facilities from their users ie community severance. Accordingly, community effects are considered within this chapter because they are directly connected to the availability of access to the community facilities.

13.1.3 The chapter is divided into two sections, considering firstly those travelling by motorised vehicle (Vehicle Travellers) and secondly those travelling on foot, by bicycle or by horse (Non-motorised Users, or NMUs).

13.1.4 Impacts on vehicle travellers are assessed by considering the impacts on views from the road and driver stress. However, in light of the clear link between views from a road and the surrounding landscape, vehicle travellers are identified as visual receptors within the assessment of impacts on landscape (Chapter 8), in line with IAN 135/10 (Ref 13.5). Therefore the assessment of impacts on vehicle travellers in this chapter will consist only of an assessment of driver stress to avoid double counting, whilst providing a summary of the findings from the Chapter 8 Landscape and Visual.

13.1.5 Impacts on NMUs, are considered through two related elements: the changes in journey lengths as a result of the scheme, and the changes in the amenity experienced on journeys as a result of the scheme. Where community effects are concerned, the DMRB Volume 11, Section 3, Chapters 5, 6 and 7 outline a methodology for assessing new, or relief from, community severance. All relevant elements of this assessment have been included within the assessments of journey length and journey amenity.

13.2 Methodology

Statutory and planning review

13.2.1 A desktop review of current legislation, planning policy and technical guidance was carried out between 30 October 2015 and 15 December 2015 to identify all relevant information to the project. The following information sources were used:

- North Ayrshire Council website (http://www.north-ayrshire.gov.uk/home.aspx)
- The Scottish Government website (www.gov.scot/)
- The UK legislation website (legislation.gov.uk)

Determination of baseline

13.2.2 The baseline for vehicle travellers and NMUs was determined through a combination of field study, desk study and consultation with relevant organisations, as outlined below (in paragraphs 13.2.3 to 13.2.10).

Study area

13.2.3 The study area for this assessment was defined using professional judgement to identify routes used by NMUs likely to be affected by the scheme. This was based on a review of existing infrastructure, the location of community facilities in the area and the main routes likely to be used by travellers to reach them. Essentially the study area is defined by the sphere of influence of any community facility in the area which intersects with the scheme.

13.2.4 The study area for vehicle travellers is the area of carriageway subject to improvement for which there is usable traffic data.

Desk study

13.2.5 Google Maps (Ref 13.6) and the Department for Environment Food and Rural Affairs MAGIC Map application (Ref 13.7) were used to identify community facilities within the study area.

Field survey

13.2.6 A 12-hour NMU survey was carried out in October and November 2013 to establish the movement of pedestrians, equestrians and cyclists in the area. Traffic modelling was also carried out and provides the hourly flow data that is required in the assessment of driver stress.

Consultation

13.2.7 Consultations were undertaken with the following organisations (further detail of which can be found in Chapter 5 of this document):

- The British Horse Society
- The Cyclists Touring Club
- Scottish Rights of Way and Access Society
- Sustrans
- Scotways
- North Ayrshire Council Transportation Department

13.2.8 The British Horse Society outlined the importance of considering equestrian travel when developing active travel solutions. Most notably, they highlighted that infrastructure such as footbridges may preclude equestrian users from making use of the off-road active travel network, but did not make reference to whether the footbridge shown in the design was adequate or whether modification to allow use by equestrians was warranted.

13.2.9 North Ayrshire Council Planning department also responded, stating that the developments were likely to enhance the usability of the area for NMUs, particularly helping to link up other nearby settlements with Beith.

13.2.10 North Ayrshire Council Transportation Department made no objection to the proposals.

Assessment of impact –motorised travellers

13.2.11 As discussed in paragraph 13.1.4, only driver stress is assessed in this chapter as an assessment of changes in the view from the road is included as part of the landscape assessment, however a summary of this assessment is offered in each of the relevant sections of this chapter as well. Driver stress can be caused by a large number of road characteristics. The DMRB Volume 11, Section 3, Part 9 states that this has three main components: frustration, fear of potential accidents and uncertainty.

13.2.12 Frustration in this context is derived from a driver's inability to drive at the speed at which they would like, as a consequence of issues such as congestion or slow moving vehicles. The DMRB guidance relates feelings of fear due to poor sight distances, low quality road surfaces or the potential for pedestrians. Finally, uncertainty whilst driving can arise from inadequate signage.

13.2.13 The relationship between the numerous contributory factors to stress and actual experienced stress levels are not sufficiently robust or well understood to allow for finely graded assessments of impact magnitude or receptor sensitivity. As such the DMRB suggests a three point descriptive scale is used (low-medium-high) to assess driver stress, taking into account the characteristics of the road in question which may contribute to driver stress, whilst considering the contributory factors outlined in paragraphs 13.2.11. Accordingly, Table 13.1 is used to draw approximate conclusions on driver stress levels based on available traffic data. The assessment of driver stress has been carried out following this methodology.

Table 13.1: Driver stress categories

Average peak hourly flow per lane, in flow Units/1 hour*	**Average journey speed (km/hr)**		
	Under 50	**50-70**	**Over 70**
Under 600	High **	Moderate	Low
600-800	High	Moderate	Moderate
Over 800	High	High	High
* A car or light van equals one flow unit. A commercial vehicle over 1.5tns, unladen weight, or public service vehicle equals 3 flow units. ** Moderate in urban areas			

Assessment of impact – non motorised travellers

Journey lengths

13.2.14 In order to assess changes in journey length and the implications for community severance, it is first necessary to identify the key journeys that are likely to be affected by the scheme.

13.2.15 The DMRB Volume 11, Section 3, Part 8 suggests two methods for establishing local travel patterns. Method A relates to situations where local travel patterns are likely to be straightforward and Method B refers to situations where local travel patterns are likely to be complex. The guidance gives no definition of "straightforward" or "complex", however it is considered that travel patterns in the study area are straightforward, based on the relatively low number of NMUs (from survey information) likely to be affected by the scheme and the fact that key journeys are most likely to be to and from the community facilities in the town centre.

13.2.16 As part of the chosen method to identify key journeys, community facilities have been identified on a map (Figure 13.1), and the catchment of relevant schools included in Figure 13.2. All other facilities shown in Figure 13.1, besides schools, are expected to attract users from the town of Beith itself and the village of Gateside. This assumption is based on the availability of similar community facilities within other nearby towns, limiting the need for people to travel to use facilities within Beith.

13.2.17 The DMRB Volume 11, Section 3, Part 8 Chapter 2 also states that the following should be taken into account when assessing the importance of travel patterns:

- Level of use
- Use by vulnerable groups, such as aged or disabled people
- Availability of alternative facilities
- Importance in its own right (ie the extent to which users require access)

13.2.18 By identifying or estimating the extent and relevance of the factors above to a chosen route, the sensitivity of travel patterns to change can be assessed, using professional judgement to apply a scale of: negligible-low-medium-high-very high. For example very high sensitivity will constitute a route with a high level of use, where a significant proportion of users are classed as vulnerable, where a distinct lack of alternatives are available, and where the facility being accessed is important; such as a school. The extent to which each of these factors is present for each route will inform a decision on how sensitive they are to change.

13.2.19 Where travel patterns are likely to be affected, measurements are made, in terms of both distance and time, of any changes in journey length likely to be experienced. These are shown in map form (Figure 13.3). The magnitude of impact of the scheme on the journey length and access to community facilities is then quantified according to the scale provided in the DMRB Volume 11, Section 3, Part 8, Chapter 6. This is designed to show the extent to which any new severance is experienced, dictated by changes in journey lengths, and the extent to which new obstacles have to be negotiated. The scales of impact magnitude along with a description of the impact are shown in Table 13:2.

Table 13.2: Magnitude of changes to journey lengths

Magnitude of impact	Description
Major	• People likely to be deterred from making journey • Change in location of centres of activity • Considerable hindrance to people making journeys • Pedestrian at-grade crossing carrying over 16,000 vehicles per year (AADT) in the opening year. • An increased journey length of 500m or more • Three or more of the hindrances set out under slight, or three from moderate
Moderate	• Some people, particularly vulnerable groups are likely to be dissuaded from making trips • Pedestrians at-grade crossing of a new road carrying 8,000-16,000 vehicles per day (AADT) in the opening year • Journey length increased by 250m-500m • Two or more of the hindrances set out under slight.
Minor	• Current journey pattern likely to be maintained, but some hindrance to movement • Pedestrian at-grade crossing of a new road carrying below 8,000 per day (AADT) in the opening year • New bridge will have to be climbed, or subway traversed • Journey length increased by up to 250m

13.2.20 Taking into account the sensitivity of the travel pattern to change and the actual change in distances travelled, an assessment of impact significance can be made, based on professional judgement.

Journey amenity

13.2.21 Amenity is defined according to the DMRB Volume 11 Section 3, Part 8 as "the relative pleasantness of the journey" and is the extent to which NMUs are exposed to traffic, noise and dirt as well as feelings of fear derived from footpath width, distance from traffic and the existence of barriers/fences. The pleasantness of the surrounding landscape may also be relevant. For cyclists and equestrians, provision of safe crossing

points is of paramount importance in addition to similar safety issues felt by other NMUs such proximity to traffic.

13.2.22 The DMRB (Volume 11, Section 3, Part 8) does not provide a specific means by which the sensitivity of journey amenity and the magnitude of impact can be assessed, rather it states that a descriptive approach should be taken in assessing journey amenity, making sure to reference expected changes in traffic flows and the number of journeys affected. However, for the assessment of journey amenity to be consistent with other assessments in this statement, an assessment of route sensitivity and impact magnitude have been carried out. Sensitivity as outlined in Table 13.3 is related to the importance of a resource. In the case of journey amenity, this importance, or value, is derived from the experience of the user when using the given route. For example a high level of amenity may be experienced as a result of the combined effect of pleasant views, a well maintained footway and good lighting. The scale over which this value has influence should also be taken into account, derived from the number of people likely to experience the route and where they are likely to have come from.

Table 13.3: Journey amenity route sensitivity

Sensitivity	Description
Very High	Very high importance and rarity, international scale and very limited potential for substitution
High	High importance and rarity, national scale and limited potential for substitution
Medium	High or medium importance and rarity, regional scale, limited potential for substitution
Low	Low or medium importance and rarity, local scale
Negligible	Very low importance and rarity, local scale

13.2.23 The magnitude of any impact, in line with Table 4.3, is derived from the loss, addition or enhancement of any of the key features which contribute to the amenity value of the route to its users. For example an improvement in the surfacing of a footway enhances the visual amenity of that route and may contribute to users being more sure footed.

13.2.24 By combining the overall level and importance of amenity along a given route and the extent to which tis is expected to change, the overall significance of an impact can be determined. This is done using the matrix shown in Table 4.4.

Table 13.4: Journey amenity impact magnitude

Magnitude of impact	**Description**
Major	Loss of resource and/or quality and integrity of receptor, severe damage to key characteristics, features or elements
	Large scale or major improvement of receptor quality, extensive restoration or enhancement, major improvement of attribute quality
Moderate	Loss of resource, but not affecting integrity, partial loss of /damage to key characteristics, features or elements
	Benefit to or addition of key characteristics, features or elements. An improvement of attribute quality
Minor	Some measurable change in attributes, quality or vulnerability, minor loss of or alteration to one (possibly more) key characteristics, features or elements
	Minor benefit to or addition of one (possibly more) key characteristics, features or elements, some beneficial impact on attribute or a reduced risk of a negative impact occurring
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements
	Very minor benefit to or positive addition of one or more characteristics, features or elements
No Change	No loss or alteration of characteristics, features or elements, no observable impact in either direction

13.3 Baseline conditions

Views from the road

13.3.1 As described in paragraph 13.1.4 above, the assessment of views from the road has been incorporated into Chapter 8 Landscape Effect. In this assessment, three receptors have been identified as being representative of views from the road (visual receptors 30,

31 and 32). Each of these, as described in paragraphs 8.3.61 to 8.3.63, was assessed as having a low sensitivity to impact.

Driver stress

13.3.2 The average speed of traffic along the A737, taking into account a number of side roads is 46km/hr. The average peak hourly flow for the base year (2013) is approximately 437 vehicles per hour. It should be noted that available traffic data does not allow for the vehicle weight–related measurement of flow units to the extent suggested in the DMRB. However, when the HGVs (average of 7%) are weighted (equivalent to three flow units as part of the driver stress assessment matrix) this rises to 497 vehicles per hour per lane. Therefore in accordance with the DMRB, the general level of driver stress experienced by drivers along the A737 is considered to be high for sections considered to be rural and moderate for sections considered to be urban.

13.3.3 However, as discussed in the methodology (paragraph 13.2.13), the driver stress assessment matrix is designed only to provide a guide to likely driver stress. It is likely that levels of driver stress are more nuanced than the assessment matrix would suggest.

13.3.4 The following existing issues relating to driver stress on the A737 were identified in the Scottish Transport Appraisal Guidance report compiled in March 2014 (Ref 13.8), following stakeholder consultation held in December 2013. They help to provide a more comprehensive picture of driver stress in the area.

Access to and from side roads

13.3.5 Access to and from side roads along the study area is a significant problem for both mainline and side road traffic, particularly during peak periods. Delay to the through traffic is often caused by vehicles turning right at the junctions of Head Street/Wardrop Street and Barrmill Road, where there is no room to pass waiting vehicles. Vehicles turning right can sometimes wait for a considerable time due to lack of opportunities to cross the opposing traffic flow. Similarly, traffic joining the A737 at these junctions is subject to delay while waiting for an opportunity to exit the junction. This is particularly difficult for right turn and straight across movements.

Visibility to and from junctions

13.3.6 Visibility from the junctions at Head Street/Wardrop Street and Barrmill Road is very poor and falls far below current standards. Junctions are also not conspicuous when approaching along the A737 and visibility is poor when exiting from side roads. Poor

visibility contributes to the difficulties experienced by vehicles exiting the side road junctions.

Road safety

13.3.7 Road safety was highlighted as a major concern through stakeholder engagement. A review of accident data for the study area indicated that accidents primarily occur at junctions and most commonly involved failure to give way at junctions, right turning vehicles and rear end shunts. These accidents are likely to result from poor visibility to and from the junctions and a lack of opportunity to exit the junction safely.

13.3.8 Due to the shortage of opportunities for exiting from side roads, drivers feel pressure to accept small gaps in mainline traffic. Originating from this pressure, frustration felt by the driver at the front of the queue is also shared by those behind. This is often expressed through horn peeping; further exacerbating the scenario and increasing the chances of an unsafe manoeuvre. Inappropriate junction layouts are also a problem. The crossroad layout at Head Street in particular has the potential to cause confusion over right of way, particularly when two vehicles are waiting at the stop line on either side of the road.

Routing of Heavy Goods Vehicles (HGV)

13.3.9 Several stakeholders raised concern over the number of HGVs leaving and joining the A737 at Wardrop Street and using the B777, C80 and A736 roads as an alternative route to/from Irvine and beyond. This results in significant numbers of HGVs routing through the village of Gateside, causing concern for local residents, and is affecting the maintenance of the Local Authority roads. It was suggested by stakeholders that this route is currently more attractive for all vehicles travelling to Irvine and beyond and avoids the congestion hotspots of Dalry and Kilwinning. It was also noted that this route is shorter and more fuel efficient than via the A737 trunk road.

13.3.10 There is currently a planning application in place for the use of Trearne Quarry as a waste disposal site to the east of Beith which has the potential to increase the number of HGVs on Main Road (leading on to Wardrop St.) and using the Head St. / Wardrop St junction.

Speeding

13.3.11 Speeding was reported by some consultees as a concern, however, the speed data collected during a data collection exercise in October and November 2013 indicated that

that majority of traffic travels within the signed speed limit of the road throughout the study area. However, the narrow nature of the carriageway may give the impression of higher speeds and create a feeling of unease. There are no speed cameras on the route.

13.3.12 Overall, drivers are likely to feel high levels of stress at junctions, in situations where they are emerging from side roads and where travelling on the A737. This, as discussed, is likely to be as a consequence of heavy traffic, limited opportunities for pulling out or turning, and the likelihood of pedestrians, particularly near Beith Primary School. Limitations on sightlines are also likely to cause short-term high stress levels as drivers cross the disused railway bridge to the south.

13.3.13 Drivers on the rest of the route are likely only to experience moderate levels of stress, as traffic between junctions is relatively free flowing, although the road is narrow and in places pedestrians are very close to the edge of the carriageway.

13.3.14 Levels of driver stress are likely to vary throughout the day. Traffic data shows very clear peaks of flow, heading towards Glasgow in the morning rush hour and returning in the evening. These are the times at which driver stress levels will reach their peak.

13.4 Baseline conditions – NMUs

Community facilities

13.4.1 Community facilities likely to influence NMU movements in the area are shown in Figure 13.1 and Table 13.5. These include a number that have the potential to be used by vulnerable groups; such as Spier's Care Home or Beith primary School. The North Ayrshire Core Paths Plan (Ref 13.9) and associated maps do not show any core paths (whose definition within the plan includes rights of way) within the study area.

Table 13.5 Community facilities

Community facility type	Details	User information
Places of Worship	Beith Old Parish Church	Likely to cater to the population of Beith
	Beith Trinity Parish Church	
	Our Lady of Perpetual Succour	
	United Reformed Church	
	Church of Jesus Christ of Latterday Saints	

Community facility type	Details	User information
	Auld Parish Kirk	
Vets	MBM Veterinary Group	Likely to service Beith and much of the surrounding countryside
Care homes	Spiers Care Home	44 residents
Libraries	Beith Library	Likely to cater to the population of Beith
Community centres	Beith Community Association	Likely to cater to the population of Beith
Health centres / medical practices	Beith Health Centre	Catchment extends to include Bankhouse, Barrmill, Gateside and The Den
	Mistylaw Medical Practice	Likely to cater to the population of Beith
Petrol stations	New Road Garage	Any vehicle using the A737 may use this facility
Secondary schools	Garnock Academy	Catchment includes Beith, however school located outwith town
Primary school catchments	Beith Primary School	Refer to Figure 13.2 for catchment details
	St Bridget's Primary School	Catchment includes Beith, however school located outwith town
	Glengarnock Primary	Catchment includes Beith, however school located outwith town
Independent/special schools	Geilsland School (14-18 yrs)	Potential for children to come from across Scotland
Public parks / sports grounds	Bellsdale Park (Beith Juniors Football Club)	Likely to cater to the population of Beith

Community facility type	Details	User information
	Meadowside Park Sports Ground	
	Marshland Sports Fields	
	Spier's Old School Grounds	
	Orr Trust Public Park	
	Larch Terrace park	
Post office	Eglinton Street Post Office	Likely to cater to the population of Beith
Sheltered housing	Laigh Court	Consists of 21 one-bedroom flats
	Dickson Court	Consists of 20 one-bedroom flats
Police station	Kilbirnie	Station located in Kilbirnie. Covers Dalry and West Kilbride, Kilbirnie and Beith
Supermarkets	Cooperative	Likely to cater to the population of Beith

Journey lengths

13.4.2 Key existing journeys that are likely to be affected by the scheme are described in paragraphs 13.4.3 to 13.4.6. These routes are shown in Figure 13.4.

Route 1: Route between Head Street and Barrmill Road

13.4.3 Levels of use of this route are likely to be low, given the availability of alternatives along Larch Terrace where users are able to keep a more comfortable distance from traffic. There are few direct connections from this route to community facilities. However, it is conceivable that NMUs may use the route to access to Spier's Old School Grounds or Marshland Sport Fields (opening the possibility for use by children), or for travelling further afield. Overall, the presence of alternative routes and the limited extent to which this path connects people to community facilities means that sensitivity to changes in journey length are negligible.

Route 2: Route from Barrmill junction to Manrahead Roundabout

13.4.4 Use of this route is estimated to be low, based on the poor state of repair of the footway. Again, the route does not link any specific community facilities, but may provide a means by which residents to the south of Beith could access Spier's Old School Grounds and Marshland Sports Fields. Alternative routes for such purposes are limited, and given the use of Marshland Sports Fields by children, there is potential for use by vulnerable groups, although probably accompanied. Overall, sensitivity is considered to be low in this assessment as a result of the very low estimated level of overall use.

Route 3: Gateside to Beith, crossing at Head Street/Wardrop Street

13.4.5 A 12-hour NMU survey was carried out in October and November 2013 as part of a data collection review. In that time (during the week), approximately 49 pedestrians crossed the A737 at the Head Street junction. Seven of these were children, although accompanied). Only two cyclists were observed and no equestrians. The variation in traveller type did not vary significantly between weekday and weekend. The importance of the facilities being visited is likely to be variable given the large number of potential destinations within Beith, eg the supermarket or health centre as shown in Figure 13.1. The sensitivity of the NMUs at this location is medium.

Route 4: Geilsland Road to Beith

13.4.6 The NMU survey mentioned in paragraph 13.4.5 above, indicated that 41 pedestrians crossed the A737 on a weekday at the Barrmill Road/Geilsland Road junction. 21 of these crossed at Geilsland Road, while 12 crossed at Barrmill Road, with the remaining 12 crossing in-between. Relative to Barrmill Road, this shows that the route is well used. It provides direct access to Spier's Old School Grounds from Beith, and has been observed to be popular with dog-walkers. The route also provides access to Geilsland School and therefore may be used by vulnerable school children (although low in number). Children are recorded in the area in general, and the school or areas of green space to which they would be travelling are of limited substitutability, and are therefore likely to be important to their users. Overall therefore, the sensitivity can be described as high.

Route 5: Barrmill Road to Beith

13.4.7 This route appears to be used to a lesser extent than Route 4, although the NMU survey does record a significant proportion of children in the area, particularly during the week.

The route provides access to the southern end of Spier's Old School Grounds and Marshland Sports Fields, as well as the numerous important community facilities within Beith if travelling in the opposite direction. Therefore sensitivity to change can also be described as high.

Journey amenity

13.4.8 Journey amenity is likely to be affected more widely than journey lengths as a consequence of the scheme, as the significance of such impacts are less dependent on actual physical changes to journeys. To consider the impacts of the scheme on journey amenity the NMU routes where amenity is likely to be affected are identified based on the nature of the route and the scheme extents and are described in the following paragraphs (13.4.9 to 13.4.16) and illustrated in Figure 13.4.

Route 1: Route between Head Street and Barrmill Road

13.4.9 Between the junctions at Head Street and Barrmill Road the footway, relative to others in the area, is generally of high quality, with reasonable surfacing and width. The route also provides open views of the land to the east, limiting the potential for substitutability. There are no designated cycleways and no facilities for equestrians however and the carriageway at this point is unlit. Levels of use are likely to be low given the availability of alternative routes, which do not involve users being in close proximity to traffic. Overall the sensitivity of this route is likely to be between low and medium. In this instance, taking a precautionary approach it is considered to be medium, taking into account its importance on a local scale.

Route 2: Route from Barrmill junction to Manrahead Roundabout

13.4.10 The route from Barrmill Road to Manrahead roundabout is of much lower quality, comparatively. The footway is poorly surfaced and very narrow. Pedestrians also find themselves between moving traffic and vehicle restraint systems. Cyclists will again have to make use of the main carriageway, in an area where, as previously discussed, sightlines are limited for traffic. The level of use is unknown, although it is anticipated to be low, based on the level of vegetation encroachment and sediment build up which is apparent from site visits. It is conceivable however that the low level of amenity discourages users. Overall, the existing journey amenity is low and the level of use is estimated to be low. The sensitivity to change therefore, is also of the route is therefore low.

Route 3: Gateside to Beith, crossing at Head Street/Wardrop Street

13.4.11 The level of journey amenity on Wardrop Street is slightly higher with a significant proportion of the route lit and featuring a footpath of reasonable width and quality with a pleasant rural backdrop. However, Wardrop Street is heavily used by HGVs, which may increase levels of dirt, noise and pollution. Given that this is the main route between Gateside and Beith, the footway will be relatively well used. Conditions for cyclists are poor, as the route lacks a designated cycle lane and will be particularly affected by HGVs.

13.4.12 There are no formal crossing points at the Head Street junction. Despite this, the NMU survey outlined in paragraph 13.4.5 indicates that 49 NMUs crossed the A737 either north or south of the Head Street Wardrop Street junction during a 12 hour period. As outlined in the driver stress section of this report, high levels of queuing traffic is an issue here, leading to increased levels of air pollution and noise. Crossing the A737 at this point, for all NMUs is likely to be a daunting prospect, particularly during peak times.

13.4.13 Overall, this route does feature relatively pleasant elements, its value can be substituted and its importance is likely only to be relevant on a local scale. However, it is likely to be used by a comparatively high number of NMUs and consequently its sensitivity is considered to be medium.

Route 4: Geilsland Road to Beith

13.4.14 Geilsland Road does not have a footpath but is likely to be used much less frequently than other side roads given its size, although access to Spier's Old School Grounds and Geilsland School can be gained from this route. This road is partially lit, and in places situated in pleasant surroundings, with dry stone walling on the northern side and particularly good views to the south, limiting the substitutability of the experienced amenity. Few vehicles use this route, although observations have indicated that, consistent with information gathered in the survey detailed in paragraph 13.4.5, the route is relatively popular with those, such as dog-walkers, wishing to access Spier's Old School Grounds. Crossing at Barrmill Road is likely to be a similar experience to that at Head Street/Wardrop Street, although this junction is more complex. Although not a nationally important resource, the route does offer some value to the local population, possibly including children. Based on this, the sensitivity to changes in journey amenity is considered to be medium.

Route 5: Barrmill Road to Beith

13.4.15 Barrmill Road features a narrow footpath on its northern side and is a lit route. Views of the surrounding fields and wider landscape are of a relatively high standard and the route provides access to Marshland Sports Fields and Spier's Old School Grounds. There are no designated cycleways on Barrmill Road. This route will involve crossing the A737 at the Barrmill Road junction.

13.4.16 Given the access available to community facilities and taking into account the relative pleasantness of the surroundings, the lack of cycle paths or equestrian facilities and the need to use a busy junction, the overall journey amenity is of mixed quality and the sensitivity is medium.

13.5 Impact assessment – vehicle travellers

Temporary impacts during construction

Views from the road

13.5.1 The visual receptors representing views from the road and assessed within Chapter 8 Landscape Effects, will experience significant adverse effects during construction as a result of the presence of moving machinery, traffic management and traffic queues. The magnitude of these impacts has been assessed as major, generating an impact significance of moderate adverse.

Driver stress

13.5.2 Driver stress during construction is likely to be generated by factors such as uncertainty of route from diversions and traffic management implemented during the construction of the scheme. Further increases in stress may arise from lower traffic speeds and increased uncertainty at junctions. However, given that the majority of the scheme will be constructed offline, disruption of this type will be limited.

13.5.3 At the time of writing, no detail can be given on the construction schedule, or on the prevalence, type or extent of traffic management or diversions. Based on this uncertainty, driver stress should be assumed, according to the precautionary principle, to be high across the entirety of the route, during construction.

Permanent impacts post construction

Views from the road

13.5.4 The assessment of views from the road carried out in Chapter 8 Landscape Effects (paragraph 8.7.13) describes an impact of slight significance for the receptors representing views from the road, resulting from disruption to views and the removal in some cases of prominent landscape features.

Driver stress

13.5.5 As discussed in paragraphs 13.3.2 to 13.3.14 above, driver stress on the existing A737 is largely derived from poor junction layout and poor sight distances in places. The scheme is likely to have a beneficial impact upon driver stress levels as it incorporates the construction of two new roundabouts where simple cross-roads had existed before.

13.5.6 Roundabouts are preferable to standard junctions as they allow gaps in traffic to be more successfully exposed and reduce confusion to drivers with respect to priority. The junction at Barrmill Road has also been simplified, with the stopping up of Geilsland Road.

13.5.7 Improved provision of shared use cycle and footways, which in many places are a significant distance from the scheme, and a dedicated footbridge reduce the potential for interaction between traffic and NMUs, further reducing levels of stress. In addition, dropped kerb crossings with central refuges are incorporated into the design formalising crossing points and increasing driver confidence.

13.5.8 A differential acceleration lane will also be provided for drivers travelling north from Manrahead Roundabout to reduce delays posed by slower accelerating vehicles. The scheme will be constructed to current standards and as such sightlines will be significantly improved. A ghost island right turn lane for drivers travelling south will also be provided to allow easier access to Thomson of Beith Garage, reducing the potential for delay on the mainline.

13.5.9 The DMRB Volume 11, Section 3, Part 9, suggests that an assessment should be carried out for the worst year (in terms of traffic) in the first fifteen years after opening. However, traffic data for the scheme only allows for an assessment of data for 2022.

13.5.10 As in the baseline section, HGVs account for three vehicle flow units, and averages for vehicle flow and average speed incorporate detail from both side roads and the mainline. For a Do-Minimum 2022 scenario (the existing A737 in 2022) the traffic model gives an

average peak hourly vehicle flow of 611 vehicles per hour with an average speed of 45km/hr. This in turn, as per Table 13.1, indicates a driver stress level of high. For the Do-Something 2022 scenario (with the scheme in place) the vehicle flow figure increases to 743, with an average speed of slightly below 50km/hr, again giving a stress level of high. This increase in driver flow is thought to be because the A737 will likely become a preferential route for vehicle travellers, taking into account the opening of the Dalry Bypass.

13.5.11 These figures are indicative and do not present a comprehensive assessment of driver stress along the route as they rely solely on traffic data. As discussed, driver stress is predominantly derived from the two main junctions on the route. These junctions will be significantly improved by the scheme and, regardless of any increases in traffic, it is likely that driver stress will be reduced to a moderate level at junctions and, as a result of reduced uncertainty, frustration and interaction with NMUs, remain at a similar moderate level in other areas.

13.6 Impact assessment – non motorised users

Temporary impacts during construction

Journey lengths

Route1: Route between Head Street and Barrmill Road

13.6.2 Impacts on this route during construction will be minimal, as much of the work on the new road will take place off-line, to the east of the existing alignment. There is a possibility that NMUs may experience some disruption where the arm of the southern roundabout is connected to Barrmill Road or where drainage from the SuDS basin opposite Larch terrace is installed. However, any changes in journey length are likely to be small, and access will be maintained for the majority of the construction period. It is possible that journey patterns for a very small number of people may be affected and that an even smaller number may be deterred from making a journey altogether. Therefore the magnitude of impact is minor. Coupled with a sensitivity of negligible, the overall significance of this impact is assessed to be neutral.

Route 2: Route from Barrmill junction to Manrahead Roundabout

13.6.3 As with Route 1, much of the construction work for this section of the scheme will take place offline. In order to travel from Barrmill Road to Manrahead Roundabout, NMUs are

unlikely to experience any change to the length of their route. It is unlikely that many NMUs will be dissuaded from making journeys or maintaining their normal travel pattern. Therefore the impact magnitude is minor (as the methodology does not allow for a lower magnitude). As the route has a low sensitivity, the significance of the impact is assessed to be neutral.

Route 3: Gateside to Beith, crossing at Head Street/Wardrop Street

13.6.4 The existing junction at Head Street/Wardrop Street will be replaced by an online roundabout. This will cause some noticeable disruption to NMU journeys between Gateside and Beith during construction. Quantification of this disruption is difficult based on the limited availability of information regarding the construction schedule. However, journey lengths are unlikely to be increased by more than 250m, causing small changes to journey patterns and possibly deterring a small number of NMUs from making their normal journey, therefore the magnitude of construction impacts on NMUs is considered to be minor. Given that the sensitivity of the route and its users is regarded as medium, the significance of this impact on journey length during construction is assessed as slight.

Route 4 (Geilsland Road to Beith) and Route 5 (Barrmill Road to Beith)

13.6.5 Where NMU journeys around the Barrmill Road junction are concerned, the sensitivity is considered to be high for Route 4 and low for Route 5. At this point the scheme will be constructed offline and at some stage of the construction process it will sever both Geilsland Road and Barrmill Road. Although at the discretion largely of the contractor, this, in a worst case scenario may result in a diversion of between 250-500m. The magnitude of this impact is therefore moderate and the overall significance of the impact is moderate for both routes.

Journey amenity

All routes

13.6.6 Users of all routes will experience a reduction in journey amenity during construction due to impacts normally associated with construction sites, including increased levels of dust, noise, light and visual intrusion. In particular, users of the routes between Barrmill Road, Geilsland Road, Gateside and Beith will need to travel in close proximity to the construction site. Journeys between the Barrmill Road junction and Manrahead Roundabout will experience the least significant impact due to the distance between the

scheme and the existing A737. The new road will also be mostly in cutting at this point, reducing the extent to which NMUs will experience negative impacts. Between Barrmill Road and Head Street, work will also take place offline, although to a lesser extent, as Drawing 25000199-100-158 shows, and users of this route may be in close proximity to the works at the junctions and to where a new SuDS basin will be constructed. Overall, it is considered that the temporary impacts during construction to journey amenity are likely to be significant given the nature of the works and level of disruption involved in constructing a new road.

Community Severance

13.6.7 During construction, it is likely that local residents may be temporarily severed from community facilities; particularly those using routes 4 and 5. NMUs on other routes may also experience minor disruption to travel patterns. It is anticipated however that alternative routes for NMUs will be provided throughout the construction period, and local residents will not be cut-off from any local amenities.

Permanent impacts post construction

Journey lengths

Route1: Route between Head Street and Barrmill Road

13.6.8 When the scheme is in place journey lengths for NMUs traveling along Route 1 will remain unchanged, both in terms of time and distance. Therefore the impact significance is neutral.

Route 2: Route from Barrmill junction to Manrahead Roundabout

13.6.9 Journey lengths for NMUs using Route 2 will also remain unchanged in terms of time and distance, and so the impact significance is neutral.

Route 3: Gateside to Beith, crossing at Head Street/Wardrop Street

13.6.10 Journey lengths at Head Street / Wardrop Street will remain unchanged in terms of distance for residents from Gateside travelling into Beith. However, users crossing the A737 to travel between Beith and Gateside will benefit from a slight reduction in time spent waiting to cross the road, as a central refuge (or ghost island) will be provided eliminating the need to wait for the carriageway to be clear in both directions before crossing. The methodology outlined in paragraphs 13.2.14 to 13.2.20 does not specifically allow for the magnitude of positive impacts to be assessed as it is derived

from the DMRB Volume 11, Section3, Part 8 assessment of new severance which does not include positive impacts. However using the descriptions from the methodology outlined for adverse impacts (Table 13.2), as journey patterns are likely to be maintained and there will be some reduction in hindrance to movement, then the magnitude of impact is assessed as minor beneficial with a subsequent beneficial impact of slight significance.

Route 4: Geilsland Road to Beith

13.6.11 As can be seen in Figure 13.3, with the scheme in place, NMUs travelling between Geilsland Road and Beith will experience an increase in journey length of around 90m using the footbridge to cross the new A737, although this may be slightly reduced for pedestrians due steps being provided as an alternative to the ramp. Based on the average speeds suggested by the DMRB Volume 11, Section 3, Part 8, this will mean a time delay of approximately 50 seconds for pedestrians and 5 seconds for cyclists. This increase in journey length is considered to have an impact magnitude of minor with a consequent impact significance of moderate (as opposed to slight, as a noticeable difference will be experienced).

Route 5: Barrmill Road to Beith

13.6.12 Between Barrmill Road north and Barrmill Road south an even greater change in journey length can be predicted. Again, NMUs will have to use the new footbridge and will have to travel an increased distance of approximately 370m. Using average speeds this will mean an approximate maximum delay of four minutes and 20 seconds for pedestrians and around one minute for cyclists. Again, this may be reduced for pedestrians who will be able to used steps to access the footbridge. To provide context, if a pedestrian were to travel from 43 Barrmill Road to Spier's Old School Grounds (a distance of around 500m), it would take approximately 6 minutes and 10 seconds, taking into account a 10 second delay in waiting to cross the road. Using the footbridge, post-construction this journey would take around 8 minutes and 40 seconds. The magnitude of this impact is considered to be moderate and the consequent impact significance is large (as there will be a noticeable change to the way NMUs interact with the A737).

13.6.13 Table 13.6 provides a summary of the permanent impacts of the scheme on journey length for each of the five routes.

Table 13.6: Journey length impact summary

Route no.	Sensitivity	Magnitude	Significance	Adverse / Beneficial
1	Negligible	No change	Neutral	N/A
2	Low	No change	Neutral	N/A
3	Medium	Minor	Slight	Beneficial
4	High	Minor	Moderate	Adverse
5	High	Moderate	Large	Adverse

Journey amenity

Route1: Route between Head Street and Barrmill Road

13.6.14 There will be a substantial improvement in journey amenity with the scheme in place. The reasons for this include the change in use of the existing A737 to a shared use cycle/foot way; improving safety through the increased distance between the new road and the proposed NMU route. This will also reduce exposure to noise, dirt and vehicle emissions. This is considered to be an improvement of moderate magnitude to the amenity value of the route, which has a beneficial impact of moderate significance.

Route 2: Route from Barrmill junction to Manrahead Roundabout

13.6.15 As previously outlined the scheme will move traffic further away from NMUs and will provide, by virtue of the existing A737, a much safer shared use route for cyclists and pedestrians. For the same reasons as the route above (paragraph 13.6.14) the magnitude of impact has been assessed as moderate, leading to a beneficial impact of slight significance.

Route 3: Gateside to Beith, crossing at Head Street/Wardrop Street

13.6.16 The re-alignment of Wardrop Street, as shown in Drawing 25000199-100-158, will incorporate a new shared use footway/cycleway on the northern side of the road. This will be connected to a dropped kerb crossing point, featuring a central refuge, which will join up with a similarly improved footway/cycleway on Head Street. Exposure to traffic for pedestrians is likely to be the same with the scheme in place, however use of the route by cyclists will be partially improved where the new route ties into the existing alignment of Wardrop Street. Views of the surrounding landscape will be much the

same, although crossing the A737 will be safer and easier as a consequence of the central refuge.

13.6.17 The improvements with the scheme in place in terms of crossing facilities and cyclist facilities is considered to have an impact magnitude of minor beneficial on this route with a beneficial impact of slight significance.

Route 4: Geilsland Road to Beith

13.6.18 This journey will be significantly altered with the scheme in place and will, as Figure 13.3 shows, require NMUs to use a footbridge to go to or from Beith using Geilsland Road. This will vastly reduce the extent to which users (in this case cyclists and pedestrians) are exposed to traffic and related noise, dirt and vehicle emissions. Views of the landscape will be improved in all directions, based on the increased elevation of the bridge. Safety will also be improved, particularly in an area where school children are prevalent. All of these factors contribute to a beneficial impact in journey amenity for this route of moderate magnitude with an impact significance of moderate.

Route 5: Barrmill Road to Beith

13.6.19 As Drawing 25000199-100-158 shows, the scheme will tie-in to the existing Barrmill Road alignment at the southern extent of Spier's Old School grounds. From this point north, NMU routes will follow the line of the existing road, separated from vehicle travellers, reducing exposure to traffic. This NMU route then travels alongside the road before crossing using the same footbridge described in paragraph 13.6.18 above. NMUs can then follow the footway/cycleway into Beith, without having to cross any further roads.

13.6.20 As with the route above (paragraph 13.6.18), journey amenity will be markedly improved, with no need for NMUs to negotiate any busy roads or junctions. Exposure to noise, dirt and vehicle emissions (particularly at this location, where concentrations of NO_2 have been found to be highest: see Chapter 6) will be noticeably reduced, and views of the surrounding landscape will be far more expansive. Therefore a beneficial impact, in terms of journey amenity, will be experienced; of moderate magnitude and moderate significance.

13.6.21 Table 13.7 provides a summary of the permanent impacts of the scheme on journey amenity for each of the five routes.

Table 13.7: Journey amenity impact summary

Route no.	Sensitivity	Magnitude	Significance	Adverse / Beneficial
1	Medium	Moderate	Moderate	Beneficial
2	Low	Moderate	Slight	Beneficial
3	Medium	Minor	Slight	Beneficial
4	Medium	Moderate	Moderate	Beneficial
5	Medium	Moderate	Moderate	Beneficial

Community Severance

13.6.22 A level of severance may be experienced on a permanent basis by NMUs using routes 4 and 5, as journey lengths and times will be lengthened. However, this is entirely as a result of the measures incorporated into the design to improve safety and journey amenity for such users. Ultimately, accessibility to community facilities will be maintained, with an increased level of safety and amenity likely to be experienced while making such a journey.

13.7 Mitigation measures

During construction

Vehicle travellers

13.7.1 Paragraph 8.8.1 in Chapter 8 Landscape Effects outlines a number of additional mitigation measures which may influence the significance of construction impacts on views from the road, including efficient traffic management and communication with local residents.

13.7.2 Advanced signage will be utilised during the construction period to inform drivers of likely future disruption. Local residents should be similarly informed of any disruption through letter drop. This activity should help alleviate, in part, avoidable driver stress issues relating to uncertainty of route and excessive congestion.

Non-motorised users

13.7.3 Although primarily at the discretion of the contractor, alternative routes can be provided during construction to NMUs of all types, which would allow for continued access to Beith from Wardrop Street, Geilsland Road and Barrmill Road. This will ensure that NMUs from

Beith and Gateside will be able to continue to access facilities throughout the construction period. Contractors should be advised to ensure local residents are kept well-informed of any changes in access.

13.7.4 Where journey amenity is concerned, contractors will be able to schedule various noisy or dusty works so as to limit the impact on NMUs nearby. Screens and acoustic barriers could also be utilised during construction, but the extent to which this will be utilised cannot be predicted.

Post construction

Vehicle travellers

13.7.5 Paragraph 8.8.3 in Chapter 8 Landscape Effect outlines a number of mitigation measures likely to influence the significance of any impact on views from the road, including planting, fencing, screening and lighting.

13.7.6 No specific mitigation measures will be required in relation to driver stress, as all reasonable steps to reduce driver stress have been taken and are inherent within the design. The scheme has been designed to comply with contemporary safety standards, with improved sight lines, greater certainty of route and priority as well as enhanced crossing facilities for NMUs.

13.7.7 Enhancements can be made to these improvements, by ensuring lane designations are clear and that drivers are aware, suitably in advance, of the junction layout. It is important also that planting only takes place, as shown in the Drawing No. 25000199/100/166, in areas where sight lines are unlikely to be affected and that NMU crossing points represent the path of least resistance for cyclists pedestrians and equestrians. This will reduce the need for NMUs to cross at unexpected places.

Non-motorised users

13.7.8 The only adverse impacts likely to be experienced by NMUs relate to increased journey lengths. These are largely the result of the inclusion of a footbridge within the design, contributing to amenity benefits and increased levels of safety. Core paths will be unaffected and no mitigation measures are necessary.

13.7.9 Further enhancement of positive impacts however may be made through planting and landscape design, increasing levels of amenity and taking the opportunity to maximise the sense of place produced by the scheme. Careful selection of a variety of species of trees and shrubs and trees will allow the scheme to perform an integrative function

allowing for a gradual visual transition from the rural east to the relatively built-up west. Hedgerows will be created to the south of the scheme while features relating to Beith's spinning heritage will be integrated into Barrmill and Manrahead roundabouts, helping to create a sense of place, as shown in the Drawing No. 25000199/100/166.

13.8 Residual impacts

Vehicle travellers

13.8.1 Table 8.12 in Chapter 8 Landscape Effects reports a residual impact significance for visual receptors representing views from the road as ranging from slight beneficial to slight adverse after year 1 and slight beneficial for all receptors after year 15 (as a result of any planting requiring time to grow). During construction, although mitigation measures relating to views from the road may help alleviate impacts on views, this will be insufficient to change the significance of any impact.

13.8.2 Driver stress during construction when mitigated, will be alleviated to some extent, however it is unlikely that the level of stress experienced by drivers will be reduced from high significance.

13.8.3 When the scheme is in place, although the traffic data-based DMRB assessment predicts that a high level of driver stress will be maintained across the scheme, it is likely that it will reduce around junctions and be maintained on the mainline, given the improved junction layout. The enhancements suggested above (paragraphs 13.7.5 to 13.7.7) would help to reduce this further, especially given an increase in through traffic.

Non-motorised users

13.8.4 During construction, changes in journey length will take place on a temporary basis during the various stages of scheme construction. However, with mitigation (paragraph 13.7.8) through the provision of alternative routes, the significance of impact will be reduced. This is completely at the discretion of the contractor, however it is reasonable to assume that access will be maintained during construction as far as possible as this is standard practice. In relation to journey amenity, the implementation of the mitigation measures (paragraphs 13.7.8 to 13.7.9) during construction will reduce the impacts, however the extent to which this will be the case is minimal, as it will still be clear that a major engineering project is being undertaken.

13.8.5 With the scheme in place, there will be an increase in journey length for routes 4 and 5 due to the inclusion of the footbridge. However, as the impacts will result from efforts to

increase safety no mitigation measures can be offered, and consequently the anticipated impacts of moderate and large significance will remain, as shown in Table 13.8.

13.8.6 In relation to journey amenity, as discussed in paragraph 13.8.4, enhancement of the levels of amenity will be achieved through planting and landscape design, and is likely to increase the beneficial impact of the scheme on journey amenity. This is described in the following paragraphs for each route and summarised in Table 13.8.

Route 1

13.8.7 With mitigation in place there will be an improvement in the magnitude of impact from moderate to major beneficial as a consequence of non-uniform planting of a mix of trees, shrubs and wildflower grassland, in addition to appropriate planting within the SuDS basin, between the new and existing A737. It is intended that the view of the rural land to the east will be maintained and that landscaping of this area will markedly enhance the experience of passing through it. The significance of the impact with mitigation will therefore be large (beneficial).

Route 2

13.8.8 This route will benefit from a new hedgerow to be planted alongside the south side existing A737 from Barrmill Road to the dismantled railway. This will be supplemented by wildflower grassland. Most notably however, Manrahead roundabout may feature planting of shrubs and silver birch trees and will be landscaped in such a way as to reflect the cultural heritage of the town, using some form of circular feature. Overall, this will enhance the sense of place experienced by users of the route and will increase the benefit resulting from the scheme to a magnitude of major. The resulting significance of this beneficial impact, after mitigation, is assessed as moderate beneficial as there will be a noticeable improvement to journey amenity.

Route 3

13.8.9 Users of this route will benefit from elements of wildflower grassland on both sides of Wardrop Street as well as tree planting on the southern verge. The roundabout at the Wardrop Street/Head Street junction will also feature the spinning wheel inspired landscaping. Again this will enhance the experience of using this route, increasing the positive magnitude of the impact from the scheme from minor to moderate beneficial, although the significance of the impact will remain slight beneficial.

Route 4

13.8.10 The benefit derived from improved views resulting from NMUs having to travel over the footbridge will be enhanced further by the fact that those users will be able to view almost the entirety of the surrounding landscape, particularly those elements around Barrmill roundabout. This consists of woodland planting, grassland, individual tree planting and wildflower grassland, creating a varied immediate landscape which will noticeably improve the amenity value of using the route. This increases the magnitude of the beneficial impact to major and the significance of impact to large beneficial (as it has been judged that a significance of very large would necessitate a more immersive or direct experience with the landscape).

Route 5

13.8.11 The enhancement provided by this route will be broadly similar to that expected on Route 4 with the exception that a different initial perspective will be gained as a consequence of the slowly rising ramp to the footbridge. Overall however, this will contribute to a beneficial impact with a magnitude of major and a significance of large beneficial given the substantial change in route and consequent views.

Table 13.8: NMU Residual impacts with the scheme in place

	Route	**Impact significance**	**Adverse/beneficial**
Journey length	Route 1	Neutral	N/A
	Route 2	Neutral	N/A
	Route 3	Slight	Beneficial
	Route 4	Moderate	Adverse
	Route 5	Large	Adverse
Journey amenity	Route 1	Large	Beneficial
	Route 2	Moderate	Beneficial
	Route 3	Slight	Beneficial
	Route 4	Large	Beneficial
	Route 5	Large	Beneficial

13.9 Statutory and planning context

13.9.1 Table 13.9 provides details of the relevant policy and legislation and also states if the scheme achieves the objectives of each.

Table 133.9: Statutory and planning context

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
The Scottish Government Scottish Planning Policy 2014 (Ref 13.10)	Opportunities for personal travel should be prioritised by mode in the following order - walking, cycling, public transport, car and other motorised vehicles. Buildings and facilities should be accessible on foot and by cycle. The aim is for urban areas to be made more attractive and safer for pedestrians and cyclists, including people with mobility difficulties. Cycle routes and, where relevant, cycle parking and storage should be safeguarded and enhanced wherever possible. Statutory equal opportunities obligations relating to accessibility to different users of different means of transport should be taken into account in development plans and development proposals.	The scheme will incorporate extensive provision of improved NMU routes, enhancing accessibility for all potential users and increasing opportunities for NMUs.	Y
The Scottish Government National Planning Framework 3 (NPF3)2014 (Ref	The NPF3 is the third document of its kind. It is described as the "spatial expression of the Government Economic Strategies" and focuses on promoting sustainable economic growth, the efficient use of energy and resources as well as the preservation and	The scheme will incorporate extensive improvements to NMU routes which will in many cases move users away from live traffic, enhancing	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
13.111)	enhancement of the environment, whilst developing physical and non-physical connections between people across the country, incorporating the following: • Buildings and facilities should be accessible on foot and by cycle. • Improvements to active transport networks. • Urban areas to be made more attractive and safer for pedestrians and cyclists. • Cycle routes and, where relevant, cycle parking and storage should be safeguarded and enhanced. • Accessibility issues and street layout and design should be part of the design and planning processes.	safety. Many areas will also be more accessible to NMUs and landscaping in the area has the potential to enhance levels of amenity experiences by cyclists, pedestrians and equestrians.	
Scotland's National Transport Strategy (NTS) 2006 (Ref 13.12)	The NTS sets out the way in which the Scottish Government intends to improve the current Scottish transport system: Through improved journey times and connections between major conurbations. Through reduced emissions. Through improving overall quality, quantity and	The scheme has the potential to improve journey times and reduce emissions as a result of the incorporation of roundabouts, as opposed to the existing junctions, which lead to standing traffic. Public	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	affordability of public transport across the country.	transport provision does not fall within the scope of this project.	
The Scottish Government Designing Streets: A Policy Statement for Scotland 2010 (Ref 13.13)	Policy statement designed to drive change in planning, focussing on place-making rather than the accommodation of motor-vehicles. Although this policy relates more closely to design in residential areas, many of its principles may also be applied to trunk roads: Design should show an intelligent response to location rather than the rigid application of standards. Site specific standards should be taken into account and move away from processes which tend to result in streets with a poor sense of place.	The landscape proposals for the scheme (25000199/100/166) helps to soften the landscape impact of the scheme and ties in to the cultural heritage of the area, helping to generate a sense of place.	Y
Transport Scotland Cycling Action Plan for Scotland 2013 (Ref 13.14)	The overall aim of the Cycling Action Plan for Scotland (CAPS) is to encourage a greater number of people to cycle and on a more regular basis. The vision states that by 2020, 10% of all journeys taken in Scotland will be by bicycle. Relevant objectives include improvements to cycle	The scheme will encourage the use of bicycles through the extensive provision of additional NMU infrastructure.	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	infrastructure and cycling promotion and education.		
Scottish Government Let's Get Scotland Walking: The National Walking Strategy 2014 (Ref 13.15)	This policy aims to encourage people to walk as part of their everyday journeys, to enjoy walking in the outdoors and promotes the design of places or spaces which encourage walking. Three strategic aims are to: • Create a culture of walking where everyone walks more often as part of their everyday travel and for recreation and well-being. • Better quality walking environments with attractive, well designed and managed built and natural spaces for everyone. • Enable easy, convenient and safe independent mobility for everyone.	The improvement of NMU infrastructure and greater ease and safety with which people are likely to be able to move across the A737 will encourage people to walk to a destination where they may previously have driven. The landscape proposals (25000199/100/166) also afford the opportunity for an improved sense of place in the area and increased levels of amenity for all NMUs.	Y
North Ayrshire Council Local Development Plan 2014 (Ref 13.16)	Outlines the development strategy for North Ayrshire for the period 2014 -2025. Relevant elements include: General Policy (d): Access on foot, by cycle, by public transport and other forms of transport should be an	Additional and improved infrastructure will be provided as a result of the scheme. Core paths, public rights of	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
	integral part of any significant development proposal. Development should have regard to North Ayrshire Council's Roads Development Guidelines and meet access, internal road layout and parking requirements. PI1: All development proposals which will result in significant trip generation shall be required to demonstrate that account has been taken of the needs of walkers, cyclists and public transport users. PI4: Development proposals affecting a Core Path route, Right of Way, or other important route, must incorporate the route within the layout of the site, or alternatively agree a diversion route with the Council, as the Access Authority. Development within close proximity to the Core Path network should provide suitable links to the Core Path network where appropriate.	way and public transport access are not relevant in this instance. Road design specification does not fall within the scope of this section of the assessment.	
North Ayrshire Local Transport Strategy 2008-	Guides actions and priorities for North Ayrshire Council on transport issues and includes the following aims: • To promote social inclusion by connecting	The scheme will help to connect communities through the increased provision of	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
2013 (Ref 13.17)	communities to facilities and services, and increasing the accessibility of the transport network. • To promote economic growth by maximising the effectiveness and efficiency of transport services, infrastructure and networks. • To minimise the environmental footprint of transport services, infrastructure and networks. • To improve the integration of the transport system between different services and modes, and with other relevant local, regional, and national policies. • To reduce accidents and enhance the personal safety of all users of the transport network, by improving the safety and security of journeys.	NMU infrastructure. The inclusion of roundabouts compared to the existing junctions will mean the A7373 is more easily accessible. There is potential for economic gains to be made through increased accessibility to and from the area by travellers of all types. Safety will be enhanced through the more effective separation of vehicle and non-motorised travellers. Uncertainty at junction may also be reduced through the inclusion of roundabouts. The integration of various transport modes is not	

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
		deemed relevant in the context of this scheme.	
North Ayrshire Draft Local Transport Strategy 2015-2020 (Ref 13.18)	As above, designed to replace existing plan, and originally due to be available for public consultation in 2015, remains in draft form. It includes the following objectives: Strengthening connections with Glasgow and the rest of Scotland through an improved transport network. Encouraging sustainable means of transport and active travel. Improving accessibility. To provide all local people with a range of suitable and sustainable transport options. To achieve modal shift from private car to sustainable transport and active travel.	The improvements to the trunk road and access to it from the surrounding areas will help strengthen connections with Glasgow. The incorporation of NMU infrastructure will encourage active travel, and in doing so proved local people with a greater choice of travel options.	Y

13.10 Limitations

Vehicle travellers

13.10.1 The assessment of driver stress is highly subjective, taking into account many inter-related factors which are not sufficiently understood to be successfully quantified. Also, traffic data does not allow for completely appropriate segregation of vehicles by weight.

Non-motorised users

13.10.2 The data used in order to inform the assessment of the impacts of the scheme on journey lengths concentrated on NMU movements in the vicinity of the junctions at Head Street / Wardrop Street and Barrmill Road. As such, it is possible that other routes in the area may not have been sufficiently represented. In addition, it was not possible to obtain information from community facility owners and managers about the number and home area of their customers and users.

13.10.3 With respect to journey amenity, the subjective nature of assessing the "relative pleasantness" of a resource is the main limitation.

13.10.4 It has also been assumed that all new NMU infrastructure can accommodate cyclists pedestrians. Very little information was available on the movements and prevalence of equestrians in the area.

13.11 Conclusion

13.11.1 In conclusion, there will be a slight beneficial impact on views from the road in the long term as a result of the scheme (as described in Chapter 8 Landscape Effects). The scheme will also reduce many of the factors that are believed likely to cause driver stress on the existing A737. This will be achieved through the improvement of visibility and sightlines as well as the incorporation of roundabouts at existing junctions that are easier to negotiate than the current arrangements. Despite the fact that traffic levels are predicted to increase, driver stress levels are likely to be reduced from the current high levels to moderate levels at junctions and remain moderate in other areas. If particular attention is paid to ensuring drivers are well informed of junction layout and lane designations, and NMUs are successfully encouraged to cross at certain points, this has the potential to reduce to low.

13.11.2 In terms of journey length, a slight beneficial impact for NMUs will be experienced at the Head Street/Wardrop Street junction based on the small predicted decrease in the time taken to cross the A737. Increases in journey distances will be experienced on two routes, both of which relate to crossing the A737; from Geilsland Road and Barrmill Road. The extended journey length will be the result of the severance of both of these side roads from the mainline and the need for NMUs to use the footbridge provided as part of the scheme. The significance of these impacts is moderate for the route using Geilsland Road and large for the route using Barrmill Road.

13.11.3 Journey amenity will generally be improved with the scheme in place. NMU crossing points will be formalised, with NMUs physically separated from traffic in certain areas and improved footway/cycleway provision. The footbridge also has beneficial impacts on journey amenity, reducing the need for NMUs to cross the A737 at ground level, and improving views of the surrounding landscape. Table 13.8 shows the significance of these beneficial impacts on journey amenity for each of the routes assessed, taking enhancement measures into account.

14 Community and Private Assets

14.1 Introduction

14.1.1 This chapter provides an assessment of the direct and indirect impacts of the scheme on community and private assets. This includes consideration of agricultural, community and designated development land that may be lost along with residential and commercial buildings that may be demolished, or have land taken from them. Mitigation measures to prevent, reduce or compensate for adverse effects are also identified.

14.1.2 Commercial properties are scoped out of the assessment as the scheme will have no likely impact upon commercial property, other than that described in the agricultural assessment. Waterway restoration projects, as described in DMRB Volume 11, Section 3, Part 6, Chapter 11, will also not be considered in this assessment due to the absence of any canals or waterways in the study area.

14.1.3 The aim of this chapter is to identify the baseline conditions, assess the potential impacts associated with the scheme, and consider appropriate mitigation. This includes:

- Identification of the type and number of private properties where demolition or land-take may be required, taking into account the viability of any affected businesses (including agriculture)
- An assessment of impact on community land such as public parks, village greens or areas used for recreation
- Identification of land which falls within the local planning authority development designations
- Identification of impacts upon agricultural land.

14.1.4 Interim Advice Note 125/09 (Ref 14.1) explains that the Community and Private Assets assessment should consist of an amalgamation of DMRB, Volume 11, Section 3, Part 6: Land Use (Ref 14.2) and the Community Effects element to DMRB, Volume 11, Section 3, Part 8: Pedestrians, Cyclists, Equestrians and Community Effects (Ref 14.3). However, in relation to community severance impacts, reference should be

made to the All Travellers Chapter (Chapter 13). Accordingly, this chapter (Community and Private Assets) will focus on the land use impacts of the scheme.

14.1.5 This chapter also considers whether public utilities in the area will be affected by the scheme (Scottish Gas, Scottish Power, Scottish Water, British Telecom and Virgin), based on consultation. This element of this assessment goes beyond that suggested by DMRB.

14.2 Methodology

Statutory and planning review

14.2.1 A desktop review of current legislation, planning policy and technical guidance was carried out between 30 October 2015 and 9 December 2015 to identify all relevant information to the project. These are identified and assessed in Table 14.11.The following sources were used:

- North Ayrshire Council website (http://www.north-ayrshire.gov.uk/home.aspx)
- The Scottish Government website (www.gov.scot/)
- The UK legislation website (legislation.gov.uk)

Determination of baseline

Study area

14.2.2 The relevant DMRB chapters mentioned in paragraph 14.1.3 do not set out specific guidelines on defining a study area. For residential, community and development land the study area for this assessment is defined by those areas which may be subject to land-take or to a change in access from the scheme. Where agricultural land is concerned, the study area includes the total area of any land holding where agricultural land is at risk of land-take, severance or change of access, in order to provide an indication of context and to help quantify the significance of impact.

Desk study

14.2.3 A desk study was undertaken to review relevant plans and policies that include information on land use and land types, including:

- North Ayrshire Council Local Development Plan (2014) (Ref 14.4)
- North Ayrshire Local Development Plan- Action Programme (2014) (Ref 14.5)

- North Ayrshire Agreed Housing Land Supply Audit (2010- 2017) (Ref 14.6).

14.2.4 The use of the Department for Environment Food and Rural Affairs MAGIC Map application (Ref 14.7) was crucial in identifying areas of community land in conjunction with land searches carried out to inform the Compulsory Purchase Order. Open spaces were identified though use of the North Ayrshire Local Development Plan Interactive Map (Ref 14.8).

14.2.5 Land capability for agriculture maps produced by the Macaulay Land Use Research Institute, now the James Hutton Institute, were key to the assessment of agricultural land in this chapter (Ref 14.9), while drawings showing the extent to which land will be acquired through compulsory purchase order have been used to quantify land-take.

14.2.6 All planning applications within the study area shown on the North Ayrshire Council Local Development Plan Interactive Map were reviewed. Only those applications on which a decision had been made were identified.

Consultation

14.2.7 Consultations were sought from North Ayrshire Council and The James Hutton Institute on development land in the area and agricultural land designations.

14.2.8 The North Ayrshire Council Senior Development Management Officer outlined that the Local Development Plan is in support of the scheme, and that the increased capacity at Manrahead Roundabout reflects "committed and future developments within North Ayrshire that are likely to lead to increased traffic flows on the A737". No response was received from the James Hutton Institute.

14.2.9 Additionally, much of the information gathered for the assessment of impact upon agricultural land was derived from interviews held with local land owners, informed by a questionnaire (Appendix 14.1). Further detail of this, along with other consultation responses can be found in Chapter 5, paragraph 5.3.7.

Site Visits

14.2.10 In addition to the site visits conducted in order to carry out the interviews mentioned in paragraph 14.2.8, 11 site visits were conducted between September 2014 and February 2016. These, along with the use of the interactive maps mentioned in

paragraphs 14.2.4 and 14.2.6 helped to inform baseline information on community land.

Determination of impact significance

14.2.11 DMRB recommends dividing land use into five different types of land use to consider the impacts of the scheme. As noted in paragraph 14.1.2, commercial land is scoped out of this assessment leaving the following four land use types for consideration:

- Private land
- Community land
- Development land
- Agricultural land

Private and community land

14.2.12 In the context of DMRB, private land refers to residential, commercial and industrial properties which require demolition or are susceptible to land-take as a consequence of the scheme. In this case, only residential properties are considered, as the scheme will not require a change of access to, the demolition of, or any land from, commercial or industrial property.

14.2.13 The impacts of the scheme on private land are established by quantifying the land taken from private property along with the number of properties affected. Where residential properties are concerned, actual buildings are deemed to be highly sensitive to impact, given that any impact equates essentially to demolition rendering them unusable. If land associated with a residential property is affected, this may not have such a substantial impact on the way in which the land is used, and therefore the sensitivity will be lower.

14.2.14 Community land includes town or village greens, public parks or other land used for recreation. The assessment of impacts on community land is informed by:

- The location, status and importance of land used by the public which is at risk
- The land-take for land used by the public
- The estimated usage of the community land
- Whether the land in question has any cultural or historical association.

14.2.15 DMRB, Volume 11, Section 3, Part 6: Land Use (Ref 14.2) does not include guidance for describing the sensitivity of private and community assets or methods for assessing the magnitude of impact. The assessment method adopted in the Environmental Statement for the Forth Replacement Crossing (Ref 14.10), is appropriate to this scheme and has been scrutinised at public inquiry. A similar approach can be found in the A9 Dualling: Luncarty to Pass of Birnam Environmental Statement (Ref 14.11) and these documents have been used to inform the assessment being carried out in this ES. Table 14.1 describes the sensitivity of private and community land while Table 14.2 sets out scales for assessing the magnitude of impact, based on the amount of demolition or land-take required by the scheme. The significance of any impacts are then assessed using Table 4.4. The limited resolution of this assessment, in particular the categorisation of impact magnitude, can on occasion lead to an under/over estimation of impact significance. Therefore, professional judgement has been used, where necessary, to supplement the outcome of any assessment.

Table 14.1: Sensitivity of receptors for use in the case of residential and community land

Sensitivity	Description
High	• Residential building • Property or land used by the community (eg play areas, schools, community halls) • Community land that attracts users nationally (eg national parks) • Cemeteries
Medium	• Residential land (eg gardens) • Land used by the community on a regional scale (eg country parks, forests and other land managed in such a way as to attract visitors from a regional development)
Low	• Derelict or infrequently used buildings • Locally used community land (eg local parks and playing fields)

Table 14.2: Magnitude of impacts on community, residential and commercial land use

Impact magnitude	Description
Major	Demolition of property, >50% loss of land and/or complete severance due to land-take
Moderate	Between 15% and 50% loss of land and/or major severance due to land-take.
Minor	<15% land loss and/or partial severance due to land-take
Negligible	Very slight change from the baseline condition. Change hardly discernible
No change	No discernible change from baseline conditions

Development land

14.2.16 Development land is land that is identified in the North Ayrshire Council Local Development Plan (Ref 14.4), or is subject to a planning application for development at some point in the future, whether for housing, commercial purposes or a community development. The assessment identifies where areas of development land are affected by the scheme.

14.2.17 To produce a consistent and comparative assessment of impact significance, the sensitivity of areas of development land and the magnitude of any impact are categorised using amended versions of the generic descriptors outlined in Tables 4.2 and 4.3, offering a more finely graded scale of sensitivity. Amendments have been made on the basis of the content of the relevant DMRB chapter (Volume 11, Section 3, Part 6) as well as EIAs of other roads schemes, including the Aberdeen Western Peripheral Route Environmental Statement, 2007 (Ref 14.12), which has been examined at public inquiry.

14.2.18 The assessment of sensitivity, as Table 14.3 shows, is based around the importance of a development in terms of its relevance to users at various scales (from international to local), the availability of alterative locations, or how location specific the development is.

14.2.19 The assessment of impact magnitude, shown in Table 14.4 takes into account the viability of the development as a consequence of the scheme, specifically in terms of

size, access and surrounding amenity. Table 4.4 is then used in order to determine the overall significance of any impact.

Table 14.3: Sensitivity of development land

Sensitivity	Description
Very high	Proposed development is of very high importance on an international scale. Very limited alternative locations
High	Proposed development is of high importance and has been implemented at a national scale. Limited alternative locations
Medium	Proposed development is of high or medium importance and has been imposed at a regional scale. Limited alternative locations
Low	Proposed development is of low or medium importance and has been implemented at local or private scale. Numerous alternative locations
Negligible	Very low importance scale. High number of alternative locations

Table 14.4: Magnitude of impacts on development land

Impact magnitude	Description
Major	All or some of the site would no longer be available for the proposed use and reduction in the viability of the development or amenity of the site in such a way as to interfere with its proposed use
	Land still available for development and large scale improvement in viability of the scheme through improvement and appropriateness of access, plus overall enhancement of amenity levels in the area
Moderate	Some reduction in land available for development, but not affecting the viability of the scheme or the amenity of the site
	Land still available for development and measurable improvement to the overall viability of the scheme through improved access and amenity
Minor	No reduction in land available for development, but some measurable change in the viability and amenity of the site
	Possible reduction in land available for development but improved viability of development through improved access and amenity

Impact magnitude	Description
Negligible	Very minor loss or detrimental alteration to the viability of the scheme
	Very minor benefit to development access and amenity
No Change	No loss or alteration to the proposed development

Agricultural land

14.2.20 The assessment of impact on agricultural land uses information gained through consultation with landowners and land managers. The methodology is derived from a number of previous EIAs conducted for projects such as the Forth Replacement Crossing, the Aberdeen Western Peripheral Route and Dalry Bypass (Ref 14.13) which have been examined at public inquiry.

14.2.21 The descriptions of the sensitivity of agricultural land to change along with the magnitude of impact are shown in Tables 14.5 and 14.6. These use information gained from questionnaires which were completed during an interview with relevant land-owners and land managers. A blank copy of this questionnaire can be found in Appendix 5..2. Table 4.4 is then utilised in order to determine the level of significance attributable to any impact.

14.2.22 Additionally, a key part of assessing the sensitivity of the agricultural land within the scheme extents is the Land Capability for Agriculture (LCA) classification which was developed by the Macaulay Institute for Soil Research (MLURI), now the James Hutton Institute (Ref 14.9). This provides a description of the agricultural potential of land, based on the degree of limitation imposed by its biophysical properties. It is based primarily on climate, a number of soil properties, (for example depth and stoniness), wetness, erosion risk and slope. Also included are the overall patterns, ie variability, and, in one classification (Class 6) vegetation cover is also taken into account. Essentially, the LCA qualifies land according to its capacity for crop production. The system provides for seven grades of land quality with a number of sub-divisions, each capable of producing specified crops to an acceptable yield standard. The defined categories can be further modified by sub-class limitations of climate, gradient, soil, wetness or erosion. Grades 1, 2 and sub-grade 3.1 are recognised as being the best and most versatile agricultural land and are collectively known as "prime quality land". The LCA of the area is also considered in terms of soil

sensitivity in Chapter 10 Geology and Soils. Classifications for the agricultural land surrounding Beith can be seen in Figure 14.1.

Table 14.5: Sensitivity of agricultural land

Sensitivity	Description
High	• Small farms size <50ha • Presence of prime quality land (category 1, 2, 3.1) • Conventionally farmed intensive arable cropping or intensive livestock systems (eg dairy cattle) • Land of any farm type farmed according to organic or biodynamic standard • High value commercial sporting activity (eg salmon fishing) • High value woodland that is rare or distinctive and susceptible to small changes
Medium	• Medium farm size (50ha-100ha) • Presence of land of moderate quality (Class 3.2-4) • Conventionally farmed mixed cropping and livestock systems of moderate intensity • Moderate value commercial sporting activity • Moderate value woodlands tolerant to moderate levels of change
Low	• Large farm size (>100ha) • Presence of land of low quality (Class 5,6 and 7) • Conventionally farmed extensive livestock systems or agricultural land in non-agricultural use • Low value sporting activity (eg rough shooting) • More commonplace woodland tolerant of noticeable change or undergoing substantial development

Table 14.6: Magnitude of impact on agricultural land

Impact magnitude	Description
Major	• Loss of more than 10% of the land holding • High degree of severance extending more than 20% of the land holding • Access to agricultural, sporting and forestry land restricted

Impact magnitude	Description
	• High degree of disruption to cultivation patterns and with high risk of change in land use • Disruption to driven shooting and /or high value fishing (eg salmon) • Noticeable change to the woodland over a wide area or an intensive change over a limited area
Moderate	• Loss of between 5% and 10% of the land holding • Moderate degree of severance extending between 10% and 20% of the land holding • Access to agricultural, sporting and forestry land compromised • Moderate degree of disruption to cultivation patterns with moderate risk of change in land use • Disruption to walked-up shooting and/or medium value fishing (eg trout) • Small changes to the woodland over a wide area or a noticeable change over a limited area
Minor	• Loss of less than 5% of the land holding • Low degree of severance extending less than 10% of the land holding • Minimal change in access to agricultural, sporting and forestry land • Minimal degree of disruption to cultivation patterns and low risk of change in land use • Disruption to rough shooting and /or low value fishing (eg no permit charged) • Very minor changes to the woodland over a wide area or minor changes over a limited area
Negligible	• Loss of between 1% and 5% of the farmed area • Low degree of severance (less than 5% of farmed area) • Access changes with minimal increase in travelling and all machinery able to access • Minimal degree of disruption to cultivation patterns and low risk of change in land use

Impact magnitude	Description
	• Disruption to rough shooting and low value fishing (eg no permit charged) • Potential for low degree of change in permanent or seasonal employment • Very minor changes to the woodland over a wide area or minor changes over a limited area
No change	• No change to all of the factors above.

Public utilities

14.2.23 The DMRB does not refer to public utilities within the Community and Private Assets guidance but these are important to consider where changes of land use are possible. Therefore consultation has been undertaken with the relevant public utility providers at various stages of the EIA process in order to ascertain any potential impact on their respective networks resulting from the scheme.

14.3 Baseline conditions

14.3.1 Each individual plot from which land will be required by the scheme is shown in Table 14.7 below. Plot numbers correspond to those in the Compulsory Purchase Order Drawing 25000199-100 CPO-LRP-CPO. The total land-take for the scheme has been calculated to be approximately 11.7ha (including servitude plots). A number of plots have been scoped out of the assessment as they do not fall under any of the DMRB categories outlined in paragraph 14.1.3. Such land areas include the existing roadway/roundabout /verge or areas of bare ground. These are identified in Table 14.7 and shaded grey to identify them as being scoped out of this assessment.

14.3.2 Finally, there are a number of very small areas of land where details of ownership are not fully understood as repeated land searches yielded no results. However in most cases, where relevant, the use of the land has been identified. It should also be noted that in the context of this assessment, land-take does not include land "previously acquired by Scottish Ministers" as shown in Drawing 25000199-100 CPO-LRP-CPO.

Table 14.7: Land owner summary

Plot No.	Owner	Occupier / lessees / user	Use	Total known holding (m^2)	Land lost as a result of the scheme (m^2)
201	North Ayrshire Council	N/A	Road/roundabout/verge	N/A	227
203	Miller (Whitestanes Farm)	N/A	Agricultural land	897,600	4,825
204	Carmichael (Manrahead Farm)	Unknown (short term leases)	Agricultural land	34,300	1,277
205	Hamilton (Roughwood Farm)	N/A	Agricultural land	776,000	5,096
206	Knox, E.M.	N/A	Dismantled railway cutting	97,400	1,049
207	Miller (Whitestanes Farm)	N/A	Agricultural land	897,600	18,478
208	Bailey (45 Barrmill Road)	N/A	Private property	934	12
209	Unknown	North Ayrshire Council	Road/roundabout/verge	N/A	680
210	Unknown	North Ayrshire Council	Road/roundabout/verge	N/A	5,666
211	North Ayrshire Council / Spiers Trust	Baillieston Farm	Agricultural land	295,909	8,057
212	Kerr, D.	Smith (Cuff Farm)	Agricultural land	31,907	24,141
213	Scottish Power	N/A	Dis-used substation	N/A	524
214	Kerr, D.	North Ayrshire Council	Road/roundabout/verge	31,907	1,496
215	North Ayrshire Council	N/A	Open space	N/A	626
216	North Ayrshire Council	Scottish Ministers	Road/roundabout/verge	N/A	5,129

Plot No.	Owner	Occupier / lessees / user	Use	Total known holding (m^2)	Land lost as a result of the scheme (m^2)
217	Landmore Estates	Unknown	Agricultural land	1,219,582	19,432
218	Unknown	North Ayrshire Council	Road/roundabout/verge	N/A	3,042
219	Miller (Whitestanes Farm)	N/A	Agricultural land	897,600	1,220
221	Landmore Estates	Unknown	Agricultural land	1,219,582	426
222	Landmore Estates	Unknown	Farmstead access track	1,219,582	64
223	Landmore Estates	Unknown	Agricultural land	1,219,582	1,994
224	Unknown	Unknown	Road/roundabout/verge	N/A	756
225	Landmore Estates	Unknown	Agricultural land	1,219,582	3,668
226	North Ayrshire Council	N/A	Bare ground/hard standing	N/A	847
227	Thomson, A. J.	N/A	Bare ground/agricultural land	3,465	889
228	Landmore Estates	N/A	Agricultural land	1,219,582	3,405
229	North Ayrshire Council/Spier's Trust	Stirling (Baillieston Farm)	Agricultural land	295,909	1,191
230	Marion Armour Fleming or Watson	North Ayrshire Council	Road/roundabout/verge	N/A	652
231	Unknown	North Ayrshire Council	Open space	N/A	170
233	Unknown	North Ayrshire Council	Road/roundabout/verge	N/A	1,269
234	London and Clydeside Estates	Unknown	Open space	N/A	135

Plot No.	Owner	Occupier / lessees / user	Use	Total known holding (m^2)	Land lost as a result of the scheme (m^2)
237	Logan (16 Barrmill Road)	N/A	Private property	1,157	25
243	Kerr, D.	North Ayrshire Council	Road/roundabout/verge	31,907	417
244	North Ayrshire Council	N/A	Open Space	N/A	246
245	Unknown	Unknown	Road/roundabout/verge	N/A	8
246	Landmore Estates	Unknown	Agricultural land	1,219,582	157
247	North Ayrshire Council	N/A	Visibility Splay	N/A	149

Private property

14.3.3 Land to the west of the existing A737 is dominated by the town of Beith; a predominantly built up area with a large number of commercial and residential properties. There are also a number of scattered properties to the east of the existing A737, along Barrmill Road and Wardrop Street. The majority of the properties within Beith will be unaffected, in terms of land-take, by the scheme. However, land-take may be required at two properties to the east of the A737. The houses themselves will not be affected, although the gardens will be at risk of a reduction in size. These properties are 45 Barrmill Road and 16 Barrmill Road.

14.3.4 Using Table 14.1, the sensitivity of residential land to change is medium, based on the fact that land (as opposed to a building) has the potential to remain usable for its intended purpose.

14.3.5 As discussed in paragraph 14.1.2 there are no industrial premises at risk of land-take as a result of the scheme. The only commercial property within close proximity to the scheme is Thomson of Beith Garage, which is not anticipated to experience any land-take, have any buildings demolished or influenced by any significant changes to access. Therefore these categories of private property are scoped out.

Community land

14.3.6 There are two areas of community land at risk of land-take. This first is the grassed area adjacent to Larch Terrace shown in Figure 13.1 and Photograph 14.1. The total area of this space is approximately 1.7ha. It is in a reasonable state of repair, contains a children's play area, a set of very old and corroded goal posts and is likely to be used for ball games or dog-walking, on a local scale by a relatively small number of people. The site has been visited on 11 occasions since September 2014. Observations conducted during such visits indicated a low level of use, to the extent that a quantitative estimation of use would serve no additional value to the assessment. The area is therefore not likely to be particularly sensitive to change. Sensitivity is considered, as per Table 14.1, to be low.

Photograph 14:1: Children's play area in green space adjacent to Larch Terrace

14.3.7 To the north of this, at Thomson of Beith Garage, lies another area of green space. This is a simple grassed area dotted with occasional trees, and has no specific purpose other than providing open space. This grassed area is unlikely to be actively used, with its key function an aesthetic one, on a local scale. Its total area is approximately 0.4ha. Based on this its sensitivity is assessed as low.

14.3.8 Additionally, a training hall, formerly at 16 Wardrop Street was demolished in 2014. The structure had been used for karate lessons, but had fallen into disrepair and was no longer used. The land was purchased by Transport Scotland in 2012 as part of an earlier roundabout scheme planned for the Wardrop Street/Head Street junction. This scheme has been superseded and included within the current A737 improvement scheme. The Stage 2 EIA noted that the loss of the training hall was of large significance, however as the building is demolished, is categorised as "land previously acquired by Scottish Ministers", and is not considered further in this assessment.

Development land

14.3.9 Within the North Ayrshire Agreed Housing Land Supply Audit (2012- 2017) (Ref 14.6) seven areas of land are identified for potential residential development in and around Beith. These areas are:

- NA0870 – 32 Kings Road
- NA0899 – Kings Road
- NA1033 – Southwest of Woodside House
- NA1037 – Hill of Beith Farm
- NA0975 – 23-25 New Street
- NA0533 – Unnamed
- NA1117 – Auldlea Road

14.3.10 None of these sites are located within the study area and as such will not be affected by the scheme. Additionally, North Ayrshire Council Planning Department were re-consulted during preparation of the ES and they did not indicate any specific developments likely to be affected by the scheme. However, the North Ayrshire Local Development Plan (2014) Map shows that part of one planning application (15/00504/PP) at Hill of Beith Farm will overlap with the land to be acquired boundary. The development in question relates to the conversion of the existing farm building to form five dwelling houses. Permission was granted to the private land owner in October 2015, subject to conditions. Given the scale of the development and the submission of the application by a private land owner, the sensitivity of the development to impact is considered to be low, by virtue of its low importance.

Agricultural land

14.3.11 All of the land immediately to the east of Beith is categorised by the James Hutton Institute, as having a land capability for agriculture (LCA) of 3.2, indicating that it is suitable for growing a moderate range of crops with a potentially high yield of grasses and arable crops. To the north of Beith the land has an LCA of 4.1, meaning that although useable for crops, only a small range of species can grow there. The southern area of the site, surrounding Manrahead Roundabout, has an LCA of 4.2 (non-prime, with a narrow range of crops). There is no prime land (soil grades 1, 2,

and 3.1) within or around the town of Beith that could be affected by the scheme. This is illustrated in Figure 14.1.

14.3.12 The DMRB (Volume 11, Section 3, Part 6) states that Environmentally Sensitive Areas (ESAs) designated (exclusively or in part) due to agricultural factors should be included within this assessment. No ESAs are located either partially or wholly, within any of the areas likely to be affected by the scheme, and accordingly are scoped out of the assessment.

14.3.13 The agricultural land surrounding the scheme is farmed or managed by a mix of tenants and owners. Details of the way in which the land is used are offered below, along with information gathered through the questionnaire described in paragraph 14.2.9. Drawing 25000199-100 CPO-LRP-CPO shows an inventory of the land owners likely to be affected by the scheme.

Agricultural land owned by Landmore Estates

14.3.14 Landmore Estates are absentee owners, based in Ireland. Their holding in the area is located around the northern extent of the scheme and is based at Hill of Beith Farm. They were contacted by email and asked to fill out the questionnaire referred to in the methodology section. No reply was received. A follow up phone call was made and some information was obtained. Further information relating to this holding was obtained through a title search. Landmore Estates own significant areas of land around the scheme. From site visits, the land has been identified as low quality semi-improved grassland with various areas of marshy ground. The land appears to be used predominantly as rough grazing, specifically for horses. The total size of the land held by Landmore Estates is approximately 122ha. A small proportion of this is used for silage, although much of it is too steep to farm in this way and it is used for grazing. This is therefore considered to be a large farm, with land-take likely in areas of moderate quality (LCA class 3.2); an area which has not been observed to be used for intensive livestock agriculture. Details of any diversification are unknown. Taking this into account the sensitivity of this agricultural land is considered to be low.

Agricultural Land owned by David Kerr

14.3.15 An area of land (2.9ha) between Barrmill Road and Geilsland Road is owned by David Kerr. The field is leased to a local farmer, based at Cuff Farm which lies approximately 2km to the east of the existing A737. The land is used by the lessee

for growing silage and is classed as non-prime (3.2) in terms of land capability. This field represents most of Mr Kerr's total holding in the area (as table 14.7 shows). Any impact on this land will have a direct impact on the viability of the land to the owner based on the ability of the land to command the current rate of rent. The sensitivity of this land to impact, when classed as agricultural land is high, fundamentally as a result of its size.

Agricultural land owned by Spier's Trust/North Ayrshire Council

14.3.16 The Spier's Trust own portions of land either side of Barrmill Road. The total area of this holding is approximately 30ha. A portion of this land, currently rented by Mr Stirling of Baillieston Farm, is at risk of land-take. The specific field lies between the property at 45 Barrmill Road and Marshland Sports Fields. Under this lease agreement, the land is used for the grazing of beef and dairy cattle as well as silage. It is classed as non-prime (category 3.2). Any impact has the potential to reduce the ability of the land to command its current rate of rent. Related to this, if the tenant was to move elsewhere, further cost may be incurred through the need for the Trust to maintain field boundaries for example. However, an informal consultation with Carolyn Wallace of North Ayrshire Council (Appendix 5.1) confirmed that the Trust does not depend on the rental income to operate. Based on the fact that most of the land owned by Spier's Trust is not agricultural and not subject to intense cropping or livestocking, and taking into account that the use and rental of the portion of the land which is agricultural and is susceptible to land-take has limited influence on the viability of the organisation, sensitivity to impact has been judged to be medium.

Agricultural land associated with Whitestanes Farm

14.3.17 Whitestanes Farm is located off the A737 to the west, south of Manrahead roundabout. The farm is predominantly a beef farm, covering an area of approximately 90ha. No additional labour is employed, however contractors are used to assist with silage. Tractors are the largest form of machinery used and the business is run as a company or firm. The farm own approximately 200 cattle. The quality of the agricultural land likely to be affected is a mix of LCA classes 4.2 (to the west of Manrahead roundabout) and 3.2 (to the west of the new Barrmill Roundabout). Based on these factors, its sensitivity to impact is medium.

Agricultural land associated with Manrahead Farm

14.3.18 This farm is situated immediately to the south of Manrahead roundabout. Manrahead Farm does not operate as a farm in a conventional sense. Only a small area (approximately 3.3ha) of land is associated with the steading. This is subject to seasonal lets and is used predominantly for silage and grazing. The machinery used on the land is likely to be similar to that used in the farms mentioned above. This is classed as a small farm, but is not farmed intensively, with the quality of the land deemed to be moderate (the majority being LCA class 4.2, with a small portion of class 3.2 land to the east of the field in question). The land does not represent the primary business interest of the owner. Overall, the sensitivity of the farm is considered to be medium.

Agricultural land associated with Roughwood Farm

14.3.19 This farm is situated to the south of Manrahead Farm, off Spiersland Way. The total land holding equates to approximately 78ha, all of which is owned. At any given time, around 50% of the land is used for grazing and 50% for silage. There are approximately 200 dairy cattle kept on the land. No permanent labour is employed, although contractors are used to take in silage and for muck spreading. The business is categorised as a partnership and large machinery used on the land includes tractors, rollers, trailers and dung spreaders etc. The business is categorised as a partnership. The farm is classed as a medium sized farm, with the land relevant to the scheme classed as being of moderate quality (LCA class 3.2). The land is used exclusively for pastoral agriculture, however the sensitivity to impact is considered to be medium.

Other land owners

14.3.20 Other owners of land considered to be agricultural in nature are identified in Drawing 25000199-100 CPO-LRP-CPO. Land (approximately 0.3ha) directly opposite Thomson of Beith Garage is low quality grassland and its use is unknown. No telephone number or email address was made available for this owner. Given that the land does not appear to be used for commercial agriculture, has no formal access, and is of low quality (although defined as class 3.2 in terms of capability for agriculture), it is not deemed to be of high importance. As such it can be considered to be of low sensitivity.

14.3.21 A further area of land lies within the boundary of the dismantled railway to the south of the scheme location totalling an area of approximately 9.7ha. This area is waterlogged and unusable for agriculture. The owner for this area of land was contacted by email, however no reply was received. The sensitivity of this area of land to change is considered to be low, due to the low quality of the land in question and its limited applicability to commercial scale agriculture.

Public utilities

14.3.22 Public utility companies were consulted with a view to consider the need for diversion routes the scheme. Descriptions of assets and the networks for service providers are outlined in paragraphs 14.3.24 to 14.3.30.

Scottish Water Network

14.3.23 Water pipes have been identified crossing both north-south and east-west under Manrahead Roundabout. From this point, a pipe follows the eastern verge of the A737 north. Connected pipes are also in place beneath Barrmill Road and Geilsland Road, where pipework cuts north to connect Geilsland School and eventually joins up with a pipe along the north side of Wardrop Street. The pipe heading along the eastern verge of the A737 continues north until just south of the Wardrop Street/Head Street junction where it splits with one pipe crossing the road and splitting further to continue north, and west along Head Street, while the other pipe heads east along Wardrop Street.

Scottish Power Network

14.3.24 There are low voltage (LV) underground (UG) cables on the west side of the existing A737 carriageway in line with Thomson of Beith Garage and High Voltage (HV) UG cables which also cross at the garage. Both LV and HV UG cables cross the A737 in line with Geilsland Road and continue east along it. HV cables also run (on the western side of the A737) from this crossing point north to Rowan Avenue where they cross back to a pole in the adjacent field. LV UG cables also cross the A737 at Barrmill Road. HV UG cables also cross Barrmill Road itself.

14.3.25 Overhead (OH) lines cross fields between Manrahead Farm and Barrmill Junction before connecting with UG network. HV OH lines also cross Wardrop Street north of

Geilsland school and connect with the pole opposite Rowan Avenue and UG network on Geilsland Road.

Scottish Gas Network

14.3.26 Gas mains cross the A737 at Barrmill Road junction and Wardrop Street/Head Street junction.

British Telecom

14.3.27 North-south underground lines pass under Manrahead Roundabout. Lines also pass under Wardrop Street. In between these two locations, underground lines also pass along the western side of the A737, in line with Glebelands Way before crossing the mainline and following the line of Barrmill Road.

14.3.28 Overhead lines are in evidence north from Manrahead Farm across the A737. Then from Geilsland School along Geilsland Road, before cutting across a field between Spier's Old School Grounds and the existing A737, and connecting to the underground network and properties at Barrmill Road.

Virgin

14.3.29 No Virgin assets were recorded in the area.

14.4 Impact assessment

Temporary impacts during construction

14.4.1 Land use impacts during construction are difficult to quantify, as these will be located and sized largely at the discretion of the contractor. There will be a requirement for welfare facilities, a site compound, materials storage areas as well as access routes. The location of these and the additional land-take required is unknown. However any impact is not likely to be significant as contractors are likely to try to minimise the footprint of the scheme and will be required to reinstate any disturbed ground.

14.4.2 There are also three plots shown in Drawing 25000199-100 CPO-LRP-CPO depicting areas of servitude. Access will be required to these on a temporary basis during construction in order to install drainage infrastructure. It is intended that these will be returned to baseline conditions however, on completion of the works. During construction therefore, access to areas of agricultural land and community land may be temporarily disrupted.

Permanent impacts post construction

14.4.3 The total areas covered by agricultural, residential and community land along with the areas of land likely to be lost as a result of the scheme, are shown in Table 14.8.

Table 14.8: Land-take for community, private property, agricultural land and development land

Land description	DMRB land type	Total known holding / area of open space (m^2)	Total permanent land-take (m^2)	Percentage land-take
Agricultural land owned by Landmore Estates	Agricultural	1,219,582	29,146	2.4
Agricultural land owned by David Kerr	Agricultural	David Kerr: 29,466 (agric. only)	24,141	81.9
		Cuff Farm: 2,180,000		1.1
Agricultural land owned by Spier's Trust/North Ayrshire Council	Agricultural	NAC/Spier's Trust: 295,909	8,057	2.7
		Baillieston Farm: 1,400,000		0.6
Agricultural land associated with Whitestanes Farm	Agricultural	897,600	23,303	2.6
Agricultural land associated with Manrahead Farm	Agricultural	34,300	1,277	3.7
Agricultural land associated with Roughwood Farm	Agricultural	776,000	5,096	0.7
Land owned by E.M. Knox (dismantled railway)	Agricultural	97,400	1,049	1.1
Land owned by A.J. Thomson (opposite Thomson of Beith Garage)	Agricultural	3,465	889	25.7
Open space adjacent to Larch Terrace	Community land	17,316	1,042	6.0

Land description	DMRB land type	Total known holding / area of open space (m^2)	Total permanent land-take (m^2)	Percentage land-take
16 Barrmill Road	Private property	1,157	25	2.2
45 Barrmill Road	Private property	934	12	1.3
Development land associated with Hill of Beith Farm	Development land	N/A	64	N/A

Table 14.9: Land –take by land type

DMRB land type	Total permanent land-take (m^2)
Agricultural land	94,871
Community land	1,191
Private property	37
Development land	64

Private property

14.4.4 No demolition of private property will be required as a result of the scheme. However land-take will be required from two residential properties. As identified in the baseline, the land-take required at 45 Barrmill Road and 16 Barrmill Road is shown in Table 14.8. This represents losses of 1.3% and 2.2%, respectively, of the total holding associated with each property. This represents a noticeable change and has the potential to influence the use of the space within the garden. The magnitude of the impact can therefore be described as minor, in the case of both properties. As noted in paragraph 14.3.4 the sensitivity of residential gardens is medium and therefore the significance of the impact of the scheme on the two residential properties is slight.

Community land

14.4.5 Community land will be lost on a permanent basis at only one location. This will take place in the area designated as open space adjacent to Larch Terrace. This area will also be severed to some extent (as shown in Compulsory Purchase Order Drawing 25000199-100 CPO-LRP-CPO) as a result of some land being lost to allow for access to a new SuDs basin and the NMU network from Larch Terrace. However, this access will be constructed of grass-crete, and is unlikely to represent a physical barrier to users within the open space, or disrupt the way in which it is used. Approximately 0.1ha will be lost from this area, a proportion of 6%, which is assessed to have a magnitude of impact of minor. It should be noted that a small additional section of land will be lost from this area (Plot 247), this is not considered to be community land or open space as it is required to be kept clear as a visibility splay. As outlined in paragraph 14.3.6, this area is used on a local scale and so its sensitivity is considered to be low. The significance of the impact of the scheme on the green space at Larch Terrace is therefore slight according to the methodology outlined in Tables 14.1 and 14.2; as some measurable impact will be sustained.

Development Land

14.4.6 Compulsory Purchase Order Drawing 25000199-100 CPO-LRP-CPO shows that approximately 64m^2 will have to be acquired from the existing access to Hill of Beith Farm, where there is an approved planning application for a private development. The land-take will be required to extend the new road boundary approximately 2.5m

beyond its current footprint to the north and to ensure that the new section of Wardrop Street is tied in to the Hill of Beith Farm access to a sufficient standard. This will not influence the ability of the developer to convert the farm buildings to dwelling houses and will not affect access to the development site in any measurable way. Therefore the magnitude of the impact is considered to be negligible and the overall significance on the viability of the development neutral.

Agricultural Land

Agricultural land owned by Landmore Estates

14.4.7 Land associated with Hill of Beith Farm and owned by Landmore Estates will sustain a 2.4% loss. As described in paragraph 14.3.14 the land is used predominantly as rough grazing, specifically for horses while the LCA classification for the land likely to be lost is 3.2 (moderate quality).

14.4.8 The northernmost field to lose land will incorporate one of four new SuDS basins to be integrated into the design. Access required for the maintenance of this basin will also allow access to the field in which it sits via an existing gate. For the fields directly south of this (where land is taken as a result of the re-alignment of Wardrop Street), the two existing field access points will be reinstated at approximately the same position, incorporating space for a tractor and trailer to pull fully off the road before passing through the gate. This field boundary is also delineated by a dry stone wall. This will be dismantled during construction and rebuilt along the revised road/field boundary.

14.4.9 Land between the existing Geilsland Road and Wardrop Street will continue to be accessed off Wardrop Street via an improved access at Plot 246, whilst an existing, but seldom used gate west of 18 Wardrop Street will be closed off.

14.4.10 Finally, a new access to this field will be provided off Geilsland Road (although a set of fenced off gateposts already exist here, suggesting a lack of use). Given that Geilsland Road will be stopped up as a result of the scheme, this may influence accessibility. However, the existing access off Geilsland road is not currently in use and it is unlikely that users will experience any noticeable impact on the way in which the field is farmed. Ultimately this field will maintain two points of access, both of which allow additional space for machinery to pull of the carriageway. All land-take

associated with this landowner will take place adjacent to the existing road network and therefore no severance of agricultural land will take place.

14.4.11 Drainage for the fields in question is generally poor, with peat occurring in places and boggy conditions often visible. Surface water flooding, likely to be in some way related to road drainage, is also a relatively regular occurrence. Where the scheme will encounter peat (north of Geilsland Road and north of Wardrop Street), this will undergo surcharge and be left in place. Elsewhere, improvements to culverts connecting land to the east of the existing A737 to underground watercourses to the west, which are known to be in place in these low lying areas, will allow the surrounding landscape to drain more effectively and freely, possibly improving conditions for agriculture. Further detail of this can be found in the Road Drainage and Water Environment chapter (15).

14.4.12 Overall, the magnitude of this impact can be described as negligible. This is as a result of the relatively small proportion of land lost, the low degree of severance and the minimal influence this will have on the way in which the land is used or accessed. Farm viability is unlikely to be affected as a result and the significance of any impact is slight (as opposed to neutral), as some measureable impact will be sustained.

Agricultural land owned by David Kerr

14.4.13 Land-take from the scheme will require approximately 2.4ha from agricultural land owned by David Kerr. As shown in Table 14.8 this amounts to a proportion of 75.5% of Mr Kerr's total known holding in the area, and approximately 81.9% of agricultural land owned by Mr Kerr. This agricultural land is currently leased to Cuff Farm, and used for silage. It falls under LCA grade 3.2.

14.4.14 The scheme will leave a small area of land to the south of the plot, which will be accessible only from Barrmill Road, rather than the current access off Geilsland Road. Although not technically severed, the land will be almost entirely encircled by the scheme and Mr Kerr has indicated that this will render the land unviable for its current purpose.

14.4.15 The loss of land will also affect the current tenant, who will lose approximately 1.1% of their farmable land. The field in question is well drained and slopes southwards towards a ditch running along the edge of its boundary with Spier's Old School Grounds. Given that the field will be almost entirely encircled by land acquired for the

scheme, there is potential for the free drainage of the land to be influenced. Overall, the magnitude of such an impact, given the likely deterioration of the viability of the land for its current use to its owner, is major. Taking into account the high sensitivity of the land, resulting from its size, the significance of such an impact is considered to be very large.

Agricultural land owned by Spier's Trust/North Ayrshire Council

14.4.16 Agricultural land owned by Spier's Trust Agricultural land owned by Spier's Trust/North Ayrshire Council will experience a permanent loss of 0.8ha. Of the total land owned by Spier's Trust/NAC this constitutes a proportion of 2.7%. When taken as a proportion of the land farmed from the lessee Baillieston Farm (as described in paragraph 14.3.16) the loss is 0.6%. The land is used for the grazing of both beef and dairy cattle, as well as silage. The land is categorised as non-prime (LCA category 3.2) and is situated approximately 7km from the farmstead.

14.4.17 Access to the field is currently available off Barrmill Road, allowing the farmer to move cattle easily between this field and others to the south, using a short stretch of the road. This is particularly important for the transportation of livestock, given that only the fields to the south have pen facilities for loading livestock into vehicles. An additional access is located off Spiersland Way to the north of the field. This will be maintained. For Barrmill Road, a new access point will be provided further to the north (also providing access to the new SuDS basin shown in Drawing No. 25000199-100-158). This may influence the extent to which the farmer is able to move cattle safely along the road, however the new SuDs access road will also allow for the provision of additional livestock pens, enhancing the opportunities for the transfer of livestock using vehicles. Land-take will take place largely adjacent to Barrmill Road, limiting the possibility of severance, however, as can be seen in Drawing No. 25000199-100-158, a small portion of land adjacent to the new SuDS basin will be severed from the rest of the field by the new access track. Details of drainage in the field concerned are limited, however drainage ditches are evident at its southern boundary. Drainage in the area is likely to be improved in general; through the implementation of new drainage infrastructure draining road runoff and surface water to the new SuDS basin.

14.4.18 Overall, the viability of the farmland will be largely unaffected, although changes to the way in which it is used may occur as a result of the change in access. Based on

this it is unlikely to significantly alter the ability of the land to command the current rate of rent (although this would have to be agreed between tenant and owner). Based on all of these factors the magnitude of impact can be assessed as minor, mainly as a result of the change in access. The significance of this impact is therefore slight.

Agricultural land associated with Whitestanes Farm

14.4.19 The total area of land owned by Whitestanes Farm is 90ha. Of this total 2.3ha will be lost as a result of the scheme (approximately 2.6%). Land will be lost at two locations; west of Manrahead roundabout and south of the existing A737 between Barrmill Road and the dismantled railway. The latter will also be severed, with the new alignment cutting through a portion of the field from east to west (as can be seen in Drawing No. 25000199-100-158). Overall the area of severed land (2.2ha) equates to 2.5% of the total holding. As described in paragraph 14.3.17, the land is used for the grazing of beef cattle and the cultivation of silage. The fields affected are a mix of LCA classes 4.2 (to the west of Manrahead roundabout) and 3.2 (to the west of the new Barrmill Roundabout). Access to the field to the west of Manrahead roundabout is currently obtained directly via the A737. The scheme will move this access slightly southwards, incorporating it into an existing access to the adjacent field.

14.4.20 Access to land to the west of the new Barrmill roundabout is obtained from numerous points. Firstly, via an informal track off the access to Manrahead Farm, secondly via a gate adjacent to 45 Barrmill Road, and thirdly; directly from the A737. On completion of the scheme, access to the northern portion of the field will be provided via the new roundabout and a stopped up section of the old Barrmill Road. This represents a noticeable change, given that currently, the field can be accessed directly from the A737. Access to the other half of the field is expected to be provided via Spiersland Way, while the informal track allowing access via Manrahead Farm may be replaced, as accommodation works, either by the contractor or the landowner (subject to negotiation).

14.4.21 The use of the southern part of the field will remain viable for its current purpose, however the additional distance, impracticality of moving animals and limited size of the northern section of the filed may limit the grazing potential of the northern section of the field.

14.4.22 Overall, given the total land lost, and taking into account the possible changes to patterns of use and the degree of severance likely to be experienced, the magnitude of the impact can be assessed, according to Table 14.6 as minor, and the consequent significance of the impact slight.

Agricultural land associated with Manrahead Farm

14.4.23 Manrahead Farm will lose approximately 3.7% of the total land holding. The majority of the land lost will be LCA grade 4.2, with a very small proportion categorised at grade 3.2. The current tenant/land user is not known, although the importance of this is limited as only short term leases are offered on the field. Land use is unlikely to change, although the ability to sustain livestock, both directly and through silage will be diminished, which in turn may reduce the ability of the owner to demand the current rent. The land owner highlighted the positive impact from the scheme from the incorporation of a new access track to be installed as part of the accommodation works for the scheme. Taking this positive impact into account, the magnitude of the impact is assessed to be minor. As described in paragraph 14.3.18 the farm is considered to have a medium sensitivity due to its small size but limited operation as an agricultural business. Overall the scheme is considered to have an impact of slight significance on Manrahead Farm given that this is the only land related to the farm, but taking into account that agriculture is not the primary business of the owner.

Agricultural land associated with Roughwood Farm

14.4.24 Roughwood farm will lose approximately 0.7% of its total farmed area as a result of the scheme. The field where land is required is around 2ha in size and is used for both grazing and silage depending on conditions and falls under LCA class 3.2. It offers two cuts of silage most years and is subsequently grazed. Access to the field is gained through another field to the southwest, and this will remain unchanged. No severance will be experienced as a result of the scheme. The field is fairly productive and well drained in most places. The use of the land and viability of the farm overall will be maintained, although its ability to sustain a certain number of animals or produce a certain volume of silage may be slightly reduced. Therefore, the impact magnitude is assessed to be minor. As described in paragraph 14.3.19 the farm is considered to have a medium sensitivity as a result of its medium size and moderate land quality. Overall the scheme is considered to have an impact of slight significance on Roughwood Farm.

Other Land Owners

14.4.25 Land owned by A.J. Thomson (0.3ha), opposite Thomson of Beith Garage, does not seem to be used for agriculture in any commercial sense and no formal access to the patch of land is provided. Approximately 25.7% of the field will be lost to the scheme. This would normally equate to a major impact magnitude, however given that there is no evidence of the land being used, professional judgement dictates that an impact magnitude of minor would be more appropriate. And the significance of any impact, slight.

14.4.26 The dismantled railway (owned by E.M. Knox) equates to a total holding, according to land search, of 9.7ha. Of this 0.1ha will be lost (approximately 1.1% of the holding). No severance will be experienced, as the land to be acquired is contiguous with the existing A737. The land is not cultivated, which negates the potential for any impacts on cultivation patterns or viability. Given that there will be some measurable loss of land, the impact magnitude can be categorised as negligible and the consequent significance of slight.

Public utilities

Scottish Water Network

14.4.27 The following installations will be made to the existing water network, in addition to a CCTV survey to be carried out pre and post construction on Wardrop Street:

- 360m of 350mm main east of Manrahead Roundabout
- 114m of 90mm main at Spiersland Way/Barrmill Road junction
- 30m of 90mm main at Barrmill Road/A737 junction
- 350m of 90mm main north of Barrmill Road junction
- 170m of 350mm main north of Barrmill Road
- 134m of 250mm main at Head Street/Wardrop Street junction
- 178m of 315mm main at Head Street/Wardrop Street junction
- 74m of 315mm main at Head Street/Wardrop Street junction
- 256m of 250mm main north of Head Street/Wardrop Street junction

Scottish Power Network

14.4.28 The following infrastructure change will be required as a consequence of the scheme:

- New HV cable joint north of Thomson's of Beith Garage
- New HV cable from join to corner of Head Street
- New ducting for underground cables in the vicinity of the Wardrop Street/Head Street junction
- New poles, ducting and HV cable across Wardrop Street to north of Geilsland School
- New HV cable and joint from Rowan Place
- New ducting at Geilsland Road
- New HV cable and joint on Barrmill Road north
- New HV cable along existing line of Geilsland Road
- To be joined to existing OH network at head of Barrmill Road south
- New poles, HV UG cable and ducting under new carriageway to the south of Glebe Road

Scottish Gas Network

14.4.29 The works will require the diversion of 110m of 63mm diameter gas pipe at the Wardrop Street/Head Street junction. 30m of 180mm and 30m of 63mm pipework will also have to be lowered by approximately 1.5m along the existing Barrmill Road. These works will require excavations, backfilling and reinstatement.

British Telecom

14.4.30 BT did not provide any specific details of work to be carried out but did provide a costing, intimating that some work will be required.

14.5 Mitigation measures

During construction

14.5.1 During the construction process it is vital that communication between the contractor and those affected by the scheme is maintained. Community land should remain

accessible where possible for the duration of the works, and local residents should be informed in advance of any disruptions to access.

14.5.2 Land owners should be informed well in advance of any intention to carry out work on their land or land which is due to be acquired, so that, in the case particularly of farmers, they may adapt their cultivation patterns accordingly. Access to agricultural land should be maintained at all times.

Post construction

14.5.3 Accommodation works have been incorporated into the scheme design in many cases, consisting mostly of the field accesses described in paragraphs 14.4.7 to 14.4.26 above. Additionally, the informal access track allowing access to farmland belonging to Whitestanes Farm, via Manrahead farm will be lost as a result of the extension of Manrahead roundabout southwards. This access may be replaced, either by the contractor, or through compensation provided to Manrahead Farm.

14.5.4 Similarly, field boundaries will have to be replaced where these have been removed to allow works to take place. For example, the new boundary around the area of land owned by Mr Kerr will be replaced, although the materials used will be subject to negotiation and the needs of the landowner. The dry stone wall along the northern boundary of Wardrop Street will also be replaced, like-for-like. Measures will also be taken to ensure adequate field drainage is maintained where there is a possibility that an impact may be sustained.

14.5.5 The conditions of the compulsory purchase order dictate that only the minimum area of land may be purchased in order to construct and maintain the scheme. There is therefore no scope for any land to be returned to agriculture on completion of the scheme. Ultimately, all land-take shown in the CPO has been taken into account in this assessment.

14.5.6 As described in paragraph 14.4.5 the scheme will require acquisition of land from an area of designated within the North Ayrshire Local Plan as "Open Space". As a result of this designation the area can also be considered to satisfy the definition of open space set out in the Acquisition of Land (Authorisation Procedure) (Scotland) Act, 1947:

"any land laid out as a public garden or used for the purposes of public recreation, or land being a disused burial ground".

14.5.7 By virtue of its categorisation as an open space, the compulsory purchase of small areas of this land will be subject to procedures in accordance with the aforementioned legislation. The act requires that where open space is to be acquired, land must be given in exchange for that lost. This exchange land must not be less in area and:

"…equally advantageous to the persons, if any, entitled to rights of common or other rights, and to the public".

14.5.8 The land lost from the area of open space (1,042m^2) adjacent to Larch Terrace will be mitigated through the provision of 1,062m^2 of additional land along the eastern edge of the space. This is shown in Drawing: A737/A738 TRUNK ROAD (IMPROVEMENTS AT BEITH) OPEN SPACE EXCHANGE LAND PROPOSALS and satisfies the definition of "equally advantageous" as a result of the area being contiguous with the existing open green space, accessible through existing means, and predominantly grassed.

14.5.9 It should also be noted that areas of land subject to servitude right to be acquired and shown as blue plots on Drawing 25000199-100 CPO-LRP-CPO will be returned to baseline condition post construction.

14.6 Residual impacts

14.6.1 The main residual impact, post-mitigation, will be the land lost as a result of the scheme; taking the form of land lost from residential properties and agricultural land.

14.6.2 The severance of the field belonging to Whitesanes Farm and small portion likely to be severed belonging to Spier's old school grounds will remain an impact, as will the possibility of the change in patterns of use for the northern section of the severed field belonging to Whitestanes Farm.

14.6.3 Access impacts will remain with accesses for land owned by the Spier's Trust, Whitestanes Farm, Hill of Beith Farm and land owned by Mr Kerr moving from their current position.

14.6.4 The loss of community land will be mitigated through the provision of additional community space, linked in to new NMU infrastructure. Impacts on development land will remain neutral, with no mitigation required.

14.6.5 Table 14.10 summarises the impacts of the scheme on land use.

Table 14.10: Residual impact summary

Land description	DMRB land type	Total known holding / area of open space (m^2)	Total permanent land-take (m^2)	Percentage land-take	Residual impact significance
Agricultural land owned by Landmore Estates	Agricultural	1,219,582	29,146	2.4	Slight adverse
Agricultural land owned by David Kerr, leased to Cuff Farm	Agricultural	David Kerr: 29,466 (agric. only)	24,141	81.9	Very large adverse
		Cuff Farm: 2,180,000		1.1	
Agricultural land owned by NAC/Spier's Trust, leased to Baillieston Farm	Agricultural	NAC/Spier's Trust: 295,909	8,057	2.7	Slight adverse
		Baillieston Farm: 1,400,000		0.6	
Agricultural land associated with Whitestanes Farm	Agricultural	897,600	23,303	2.6	Slight adverse
Agricultural land associated with Manrahead Farm	Agricultural	34,300	1,277	3.7	Slight adverse
Agricultural land associated with Roughwood Farm	Agricultural	776,000	5,096	0.7	Slight adverse
Land owned by E.M. Knox (dismantled railway)	Agricultural	97,400	1,049	1.1	Slight adverse

Land description	DMRB land type	Total known holding / area of open space (m^2)	Total permanent land-take (m^2)	Percentage land-take	Residual impact significance
Land owned by A.J. Thomson (opposite Thomson of Beith Garage)	Agricultural	3,465	889	25.7	Slight adverse
Open space adjacent to Larch Terrace	Community land	17,316	1,042	6.0	Neutral*
16 Barrmill Road	Private property	1,157	25	2.2	Slight adverse
45 Barrmill Road	Private property	934	12	1.3	Slight adverse
Development land associated with Hill of Beith Farm	Development land	N/A	64	N/A	Neutral
* 1,062m^2 of community land to be provided in exchange. Refer to paragraphs 14.5.6 to 14.5.8.					

14.7 Statutory and planning context

14.7.1 Table 14.11 provides details of the relevant policy and legislation and also states if the scheme achieves the objectives of each.

Table 144.11: Statutory and planning context

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives (Y/N)
The Scottish Government National Planning Framework 3, 2009 (Ref 14.14)	The Scottish National Planning Framework (NPF3) sets out the spatial strategy for Scotland's development to 2030. The key aims of the strategy for Scotland's spatial development to 2030 are: to contribute to a wealthier and fairer Scotland by supporting sustainable economic growth and improved competitiveness and connectivity to help build safer, stronger and healthier communities, by promoting improved opportunities and a better quality of life, and to contribute to a smarter Scotland by supporting the knowledge economy.	Land use should support the following primary activities: • Food production • Flood management • Carbon storage Changes to land use resulting from the scheme have the potential to increase the efficiency of food production through a contribution to improved transport infrastructure; has the potential to improve flood management through updated drainage infrastructure and the potential to provide carbon storage through appropriate landscaping.	Y
The Scottish Government	Rural Development Policy: Strategy for rural development should respond to the specific	The scheme will improve access to and from the area, enhancing the	

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives (Y/N)
Scottish Planning Policy 2014 (Ref 14.15)	circumstances in an area and reflect the overall aim of supporting diversification and growth of the rural economy.	potential for growth of existing businesses and diversification.	
	Sustainable Development Policy: maintain, enhance and promote access to open space and recreation opportunities support healthier living by improving the quality of the built environment, by increasing access to amenities, services and active travel opportunities, and by addressing environmental problems affecting communities.	Access to and from the area will be improved for motorists and non-motorise users in general, encouraging active travel and the use of open spaces. New infrastructure, especially when coupled with appropriate landscaping also has the potential to improve users' experience of the built environment.	Y
Choosing Our Future: Scotland's Sustainable Development Strategy 2005 (Ref 14.16)	Part 7 of this policy aims to ensure the promotion of high quality community spaces which help to connect communities to amenities and facilities, preferably through active travel.	The scheme has the potential to provide new community spaces and promote active travel, with particular reference to open space being offered in exchange for that lost adjacent to Larch Terrace.	Y
North Ayrshire	Policy ENV 1: Policy ENV 1: New Development in	The local planning authority has also	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives (Y/N)
Local Development Plan 2014 (14.4)	the Countryside (excluding housing) - Proposals for new development within the countryside (excluding housing) shall not accord with the LDP unless certain criteria are satisfied. This development satisfies the relevant criteria through its definition as an essential public infrastructure project where its location within the countryside has been sufficiently justified.	confirmed their support of the project.	
	Policy ENV 4: Farmland - Proposals for development which would lead to the permanent loss of prime quality farmland on mainland North Ayrshire or the Cumbraes (Grades 1, 2 and 3.1 on the Macaulay Institute Agricultural Land Classification Maps) shall not accord with the LDP unless the permanent loss of such farmland is outweighed by the importance of the development.	The scheme will result in no loss of prime quality farmland.	Y
	Policy ENV 12: Development of Open Space - Development of land identified on the LDP Maps	As a result of the loss of an area of open space adjacent to Larch	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives (Y/N)
	as protected open space, including school playing fields, and small areas of recreational and amenity open space, not individually identified on the LDP Maps, shall not accord with the LDP unless certain conditions can be met.	Terrace, the scheme will incorporate the addition of contiguous and equally advantageous land in exchange (as detailed in paragraphs 14.5.6 to 14.5.8).	
Planning etc. (Scotland) Act 2006 (Ref 14.17)	Stipulates that the concept of sustainable development should be incorporated into the National Planning Framework and planning authority local development plans.	The scheme incorporates elements of each of the three pillars of sustainability, with the potential to benefit the economy through improved connectivity, the potential for social benefits resulting from opportunities for active travel and enhanced mobility for travellers generally. Finally environmental considerations are taken into account with mitigation proposed where significant adverse impacts are identified.	Y

14.8 Limitations

14.8.1 Where information was gained, specifically from land owners, the detail was variable, which in turn may lead to inconsistencies in the accuracy of the assessment. This was largely the result of the level of information provided by land owners. Additional limitations included the appropriateness of the questionnaire, as its design was slightly more suited to larger, more complex arable farms.

14.8.2 Additionally, as described in paragraph 14.2.15, the resolution of the assessment of impact magnitude on private and community land allowed for a large proportion of land to be lost before the magnitude category was increased, allowing for the impacts to be underestimated, and requiring the assessment result to be supplemented by an element of professional judgement.

14.8.3 The DMRB also does not provide an assessment methodology for public utilities and consequently only a description of their relationship with the scheme has been offered.

14.9 Conclusion

14.9.1 Table 14.10 shows the residual impacts on land use as a result of the scheme. Two residential properties (16 and 45 Barrmill Road) are expected to lose land as a consequence of the scheme. The significance of impacts on these properties is likely to be adverse and slight, as a result of the relatively small proportion of each garden likely to be affected.

14.9.2 The loss of community land will be successfully mitigated and arguably enhanced by the scheme, allowing greater access to NMU routes and increasing the space for recreation.

14.9.3 Agricultural land will sustain the most noticeable impact as a result of the scheme. The significance of these impacts for each individual farm is shown in Table 14.10 above; ranging from slight adverse to large adverse for land belonging to Mr Kerr.

14.9.4 The only development land likely to be affected is that belonging to Hill of Beith Farm. The significance of this impact was judged to be neutral as a result of there being no perceptible changes to access and no likely influence on the future viability of the development.

15 Road Drainage and the Water Environment

15.1 Introduction

15.1.1 The purpose of this chapter is to assess the potential impact on the water environment that may result from the A737 Improvements at Beith. This has been carried out in accordance with The Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 10; Road Drainage and the Water Environment (Ref 15.1) and includes:

- The effect of routine runoff on surface water
- The effect of routine runoff on groundwater, in addition to a qualitative assessment of the physical effects on groundwater resources
- The risk of a pollution incident as a result of accidental spillages
- An assessment of flood risk and potential impacts.

15.1.2 In terms of the water environment, the potential issues resulting from the scheme may include:

- Increased levels of routine runoff with the potential to contaminate receiving watercourse or groundwater from increasing the impermeable road surface area
- The potential for an accidental spillage leading to a significant pollution incident during construction and operation
- Increased surface water flooding from increasing the impermeable road surface area

15.2 Methodology

15.2.1 The Scottish Government and European Union place a high importance on maintaining and improving the quality of drinking water, watercourses, groundwater and coastal water. Any runoff from a road which is not properly managed can result in significant damage to the existing hydrology and resident biodiversity. Pollution of the water environment through surface water runoff can arise from a variety of sources including accidents, vehicle and road degradation, and oil leaks. Water pollution is defined by the following three categories:

- Diffuse pollution that arises from widespread activities such as agriculture or atmospheric deposition. Routine runoff is generally regarded as diffuse pollution, but in some instances can be categorised as point source pollution.

- Acute pollution that occurs as a result of severe, but transient impacts, such as accidental spillage. Acute pollution could also result from a sudden discharge of silt–laden water during construction.
- Chronic pollution that is the result of ongoing low levels of pollution which may result in either lethal or non-lethal effect, the latter including reduced feeding/growth/breeding rates in certain organisms and hence impact on the ecosystem.

Statutory and planning review

15.2.2 A desktop review of current legislation, planning policy and technical guidance was carried out between 30 October 2015 and 10 December 2015 to identify all relevant information to the project. The following information sources were reviewed:

- Scottish Planning Policy, Managing Flood Risk and Drainage 2014 (Ref 15.2)
- Scotland the Hydro Nation, Prospectus and Proposals for Legislation 2012 (Ref 15.3)
- The Water and Water Services (Scotland) Act 2003 (Ref 15.4)
- The Water Environment (Oil Storage) (Scotland) Regulations 2006 (Ref 15.5)
- The Water Environment (Controlled Activities) (Scotland) Amended Regulations (CAR) 2013 (Ref 15.6)
- Flood Risk Management (Scotland) Act 2009 (Ref 15.7)

Determination of baseline

Study area

15.2.3 The scheme passes through two river catchment areas. Covering the northern and southern extremities of the scheme and extending to the west of the works, is the catchment of the Black Cart Water. The central section of the new roadway however, will fall within the catchment of the River Garnock.

15.2.4 Nearby settlements are the town of Beith, as well as Lochwinnoch to the north, Kilbirnie to the west and Glengarnock to the southwest, while the land cover in-between is largely agricultural with elements of designed landscape, managed woodland and opencast mining.

15.2.5 The DMRB does not provide a method for delineating a study area. In this case, the study area incorporates only those waterbodies, including groundwater, or areas of

potential flooding with which the scheme will have a likely interaction. This is discussed in detail in the baseline section (15.4).

Desk study

15.2.6 A desktop study was carried out using various resources and relevant reports. The "Scotland's Environment" website (Ref 15.8) was utilised to establish the quality of waterbodies within the study area (described in paragraph 15.2.3), using a five point scale (high-good-moderate-poor-bad) derived from the River Basin Management Plan for the Scotland River Basin and using objectives derived from the legislative context identified above. The MAGIC interactive online mapping tool (Ref 15.9) was also used to provide information on environmentally sensitive sites. The SEPA flood risk management map was utilised (Ref 15.10) to establish the existence of any flood risk within the study area. In addition, Ground Investigation Reports compiled for the site and a CCTV Survey Report, compiled in May 2014 by Lanes Group Plc provided details on current site conditions.

Site walkover

15.2.7 A site walkover was carried out in February 2014 in order to obtain information with respect to the existing drainage layout.

Consultation

15.2.8 As outlined in Chapter 5 of this document, consultations were undertaken with a number of organisations with an interest in the water environment, including:

- The Scottish Environment Protection Agency (SEPA)
- Scottish Natural Heritage (SNH)
- North Ayrshire Council (NAC)

Assessment of impact

15.2.9 The following assessment methods fall under a simple assessment as defined in DMRB HD45/09.

Impact of routine runoff on surface waters

15.2.10 Routine runoff is the normal runoff from roads, which may contain contaminants. The potential acute or chronic impacts resulting from contaminated runoff should, according to the DMRB Volume 11, Section 3, Part 10 be assessed using the Highways Agency

Water Risk Assessment Tool (HAWRAT) (Ref 15.11). This assessment is carried out in accordance with Assessment Method A (Volume 11, Section 3, Part 10, Annex 1, Method A).

15.2.11 The HAWRAT tool has been developed as a result of collaboration between the Highway England (formerly the Highways Agency) and the Environment Agency, and can be used in this assessment as traffic levels are above the 10,000 AADT (Annual Average Daily Traffic) threshold set out in the DMRB Volume 11, Section 3, Part 10.

15.2.12 HAWRAT has three levels of assessment:

- Step 1 considers runoff quality prior to any pre-treatment and discharge to a water-body
- Step 2 assesses the acute and chronic in-river impacts after dilution and dispersion
- Step 3 provides an assessment of in-river impact after mitigation

15.2.13 The inputs and outputs of HAWRAT for each step are detailed in Table 15.1. This shows how the assessments at steps two and three are dependent upon the result of the preceding step. HAWRAT utilises a pass/fail methodology where fail either indicates an unacceptable risk and a need to carry out further assessment or the need to seek specialist judgement from SEPA and the Overseeing Organisation.

15.2.14 Step two includes two further levels of assessment (tier 1 and tier 2) that are dependent on sediment accumulation. If no risk is identified in the tier 1 assessment then a tier two assessment is not required. In addition, one of the key input figures required is the low flow parameter for the receiving watercourse which is defined as "the flow equalled or exceeded in a watercourse 95% of the time" (DMRB, Volume 11, Section 3, Part 10 Annex 1, Method B), referred to as Q95. Due to the size of watercourses in the study area and the lack of data available in relation to their flow, it was decided to derive a Q95 figure (as carried out in the Stage 2 EIA) from the outfall relating to each of the SuDS basins integrated into the scheme design. In the absence of flow data, this is thought to be representative of the low flow for the receiving watercourses.

Table 15.1: Steps in HAWRAT assessment

Stage of assessment	Inputs	Outputs
Step 1 Runoff quality	Traffic volume	Runoff concentrations of soluble pollutants and sediment-bound pollutants for each event
	Geographical location	Pass/fail standards
	10 years of rainfall data (embedded in HAWRAT)	
Step 2 In-river	Outputs from step 1	Concentration of soluble pollutants after dilution
	Area (permeable and impermeable) draining to outfall	
	95th%ile flow	
	Base flow index (BFI)	
	Water hardness	
	Judgement on whether discharge is 1km upstream of designated site	
	Characteristics of receiving watercourse (tier 1 requires river width only, tier 2 assessments require bed width flow width, Manning's number, side slope and long slope)	Stream velocity at low-flow
		Deposition index (extent of sediment coverage)
		Percentage settlement required to comply with deposition index
		Annual average concentrations of soluble pollutants
Step 3 After mitigation	Outputs from steps 1 and 2	Concentration of soluble pollutants after treatment
	Existing and proposed mitigation measures.	Concentrations of soluble pollutants after further dilution
		Pass/fail standards
		Annual average concentrations of soluble pollutants after mitigation

Effects of routine runoff on groundwater

15.2.15 In line with advice provided by SEPA, stating that a detailed assessment of groundwater impacts is not required, the assessment of the effects of routine runoff on groundwater is carried out in accordance with Method C as stipulated by the DMRB in Volume 11, Section 3, Part 10 Annex I. This method makes use of a number of factors in order to assess the level of risk that groundwater is likely to be exposed to, taking into account both pollutant sources and pathways. The following information is required:

- Traffic density, based on an established relationship between traffic volumes and pollutant concentration in runoff
- Rainfall volume or intensity, based on the ability of rainwater to transmit pollutants. The rainfall value (volume or intensity) which produces the highest risk level should be used in the assessment in line with the precautionary principle
- Soakaway design and geometry
- Unsaturated zone, where increased depths influence the opportunity for attenuation of pollutants
- Flow type, in particular relating the interaction between migrating fluids and particles, soils and rock types
- Effective grain size based on the influence this has on hydraulic conductivity
- Lithology, relating to the varying ability of different rock types to encourage microbial colonisations and, physically attenuate pollutants.

Spillage

15.2.16 The assessment of the impacts of accidental spillages has been carried out using HAWRAT in accordance with Method D in Annex I of the DMRB Volume 11, Section 3, Part 10 and this helps to inform the impact magnitude assigned to groundwater and surface water impacts derived from routine runoff. The inputs to HAWRAT for the spillage assessment are traffic flow, road length and the concentration of Heavy Goods Vehicles (HGVs). Based on this, HAWRAT produces a probability for the incidence of a spillage which will result in a serious pollution incident. In most circumstances, according to the DMRB Volume 11, Section 3, Part 10, the acceptable level of risk is where the annual probability of this occurring is expected to be less than 1%. If the output indicates an unacceptable risk, then consideration should be given to what changes

could be made to the design to reduce the risk, such as outfall relocation or the inclusion of SuDS.

15.2.17 Using these analysis techniques, resource importance and impact magnitudes can be quantified using Tables 15.2, 15.3 and 15.4. A separate table, different to that outlined in Chapter 4, is required to assess impact significance. This is provided in Table 15.5 below, taken directly from DMRB HD45/09.

Flooding

15.2.18 NAC have been consulted during the development of the drainage design, and are content with the proposals. They have indicated that a Flood Risk Assessment is not required. Therefore DMRB HD45/09 Methods E and F have been scoped out of this assessment.

Fluvial geomorphology

15.2.19 Fluvial geomorphology is not referred to within DMRB, however it is a consideration under WFD where geomorphological features are supporting elements. It is not considered that the scheme will affect fluvial geomorphology as there are very few interactions between the scheme and water bodies. There are no additional outfalls as a result of the scheme and the flow into existing outfalls will be controlled at a lower rate with the scheme in place. Further, the outfalls are not to water bodies that are included in the RBMP classification, rather they are to field drains or culverted watercourses with no geomorphological interest. Therefore impacts on fluvial geomorphology have been scoped out of this assessment. This conclusion is supported by SEPA, who indicated that the scheme would have no significant adverse effect on fluvial geomorphology.

Reporting assessment of impact

15.2.20 Using the outputs from the processes outlined in paragraphs 15.2.10 to 15.2.17 and predicted changes to the physical form of receptors, as described in the baseline section (paragraph 15.3.1), the following three tables are used to evaluate the importance of each type of water receptor along with the magnitude of impact likely to be experienced as a result of the scheme. The criteria and descriptors in Tables 15.2 and 15.4 are taken directly from the DMRB Volume 11, Section 3, Part 10, with the latter having the capacity to describe adverse impacts only. Where groundwater is concerned, the guidance provided for establishing the importance of groundwater bodies in the DMRB is more suited to the system of groundwater classification in England. Therefore an alternative

categorisation has been developed, based on that used for the Forth Replacement Crossing Environmental Statement 2009 (Ref 15.12).

Table 15.2: Surface water receptor importance

Importance of receptor	Criteria	Description
Very high	Attribute has a high quality and rarity on regional or national scale.	• Surface water • WFD class 'high' • Site protected/designated under EC or UK habitat legislation (SAC, SPA,SSSI, Water Protection Zone (WPZ), Ramsar Site, Salmonid water/European protected species
High	Attribute has a high quality and rarity on local scale	• Surface water • WFD class 'good' • Species protected under EC or UK habitat legislation
Medium	Attribute has a medium quality and rarity on local scale	• Surface water • WFD class 'moderate'
Low	Attribute has a negligible quality and rarity on local scale	• Surface water • WFD class 'poor'

Table 15.3: Groundwater receptor importance

Importance of receptor	Criteria	Description
High	Attribute has a high quality and rarity on regional or national scale.	Local aquifer(s) constitutes a valuable resource as a consequence of its high quality and yield, or extensive exploitation for public, private domestic, agricultural and /or industrial supply. Designated sites of nature conservation dependent on groundwater.

Importance of receptor	Criteria	Description
Medium	Attribute has a high quality and rarity on local scale	Local aquifer(s) are of limited value because quality does not allow potable or other quality sensitive uses. Exploitation of local groundwater is not extensive. Local areas of nature conservation known to be sensitive to groundwater impacts.
Low	Attribute has a medium quality and rarity on local scale	Poor groundwater quality and /or low permeability make exploitation of groundwater unlikely. No know past or existing exploitation of this waterbody. Changes to groundwater not expected to have an impact on local ecology.
Negligible	Attribute has a negligible quality and rarity on local scale	Very poor groundwater quality and/or very low permeability make exploitation of groundwater unfeasible. Private water supplies abandoned. Changes to groundwater are irrelevant to local ecology.

Table 15.4: Magnitude of impact categories for surface water and groundwater

Magnitude of impact	Criteria	Description
Major	Results in loss of attribute and / or quality and integrity of the attribute.	**Surface water** • Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A, Annex I) and compliance failure with Environmental Quality Standard (EQS) values. • Calculated risk of pollution from a spillage >2% annually (Method D, Annex I) • Loss or extensive change to a fishery • Loss or extensive change to a designated nature conservation site

Magnitude of impact	Criteria	Description
		Groundwater • Loss of, or extensive change to, an aquifer • Potential high risk of pollution to groundwater from routine runoff – risk score>250 (Method C, Annex I) • Calculated risk of pollution from spillages>2% annually (method D, Annex I) • Loss of, or extensive change to, groundwater supported designated wetlands
Moderate	Results in effect on integrity of attribute, or loss of part of attribute.	**Surface water** • Failure of both soluble and sediment –bound pollutants in HAWRAT (Method A, Annex I) but compliance with EQS. • Calculated risk of pollution from spillages >1% annually and <2% annually • Partial loss of productivity of a fishery **Groundwater** • Partial loss or change to an aquifer • Potential medium risk of pollution to groundwater from routine runoff – risk score 150-250
Minor	Results in some measurable change in attributes quality or vulnerability	**Surface water** • Failure of either soluble or sediment bound pollutants in HAWRAT • Calculated risk of pollution from spillages >0.5% and <1% annually **Groundwater** • Negligible potential risk of pollution to groundwater from routine runoff – risk score,150 • Calculated risk of pollution from spillages > 0.5% annually and <1% annually

Magnitude of impact	Criteria	Description
		• Minor effects on groundwater supported wetlands
Negligible	Results in effect in attribute, but of insufficient magnitude to affect the use or integrity	The proposal is unlikely to affect the integrity of the water environment. **Surface water** • No risk identified by HAWRAT (pass achieved for both soluble and sediment-bound pollutants) • Risk of pollution from spillages <0.5% **Groundwater** • No measurable impact upon an aquifer and risk of pollution from spillages <0.5%

Table 15.5: Water and drainage impact significance matrix

		Magnitude of impact			
		Negligible	Minor	Moderate	Major
Receptor importance	Very High	Neutral	Moderate/ large	Large/ very large	Very large
	High	Neutral	Slight/ moderate	Moderate/ large	Large/ very large
	Medium	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Slight	Slight/ moderate

15.3 Baseline conditions

Surface waters

15.3.1 The location of all watercourses in the catchment with which the scheme is likely to have an interaction can be seen in Figure 15.1. The largest watercourse in the area is the Powgree Burn, located approximately 750m south of the existing A737 and flowing from northeast to southwest. Kilbirnie Loch is the largest waterbody linked to the road

drainage network, located approximately 1km to the northeast of Manrahead Roundabout.

15.3.2 Powgree Burn (SEPA ID 10727) is classified by SEPA as having an overall status of moderate with medium confidence in this assessment, as of the most recent River Basin Management Plan (RBMP) cycle (2014). RBMPs are a requirement of the Water Framework Directive as described in Table 15.2. The overall ecological status of the waterbody is described as moderate (medium confidence in class) and it has an overall chemical status of pass. Diffuse source phosphorus pollution has been identified as a reason for this. The current status of the waterbody does not meet the requirements of the Water Framework Directive and it is designated within a Drinking Water Protection Zone; therefore it is particularly important that no deterioration of quality takes place as a consequence of the scheme. According to the Ayrshire Rivers Trust the burn also provides habitats for numerous species of fish such as salmon (protected under UK habitats legislation), trout, eels and sticklebacks. Chapter 9: Ecology and Nature identified also identified otter spraint at Powgree Burn, although it is though that this are only represents part of the species' home range, rather than its preferred habitat. Based on the moderate overall quality of the watercourse, the fact that it supports significant ecology, and the need to ensure that this quality is maintained, its overall importance is considered to be high (in accordance with Table 15.2).

15.3.3 The Kilbirnie Loch (SEPA ID 100300) is classified as having an overall and ecological status of moderate with high confidence as of the most recent 2014 RBMP cycle. The associated data sheet for the waterbody identifies both point source and diffuse source phosphorus pollution from farming, manufacturing and sewage disposal as contributory factors to this. Its chemical status is a pass (with low confidence). The loch is also known to be stocked with pike, roach as well as both rainbow and brown trout. Such species are protected under The Conservation of Habitats and Species Regulations 2010. This is particularly relevant as it is likely that much of the road drainage will enter the loch, via a number of drainage conduits which are discussed in further detail in paragraph 15.3.6. Based on the numerous other pollution sources influencing the overall quality of the loch, but taking into account the proportion of road drainage likely to enter it, the loch can be considered to be of high importance (in accordance with Table 15:2).

15.3.4 The River Garnock runs roughly north-south through Kilbirnie and Glengarnock and has a confluence with the Powgree Burn to the west of Beith. The overall status of the waterbody at this point (SEPA ID 10381) is bad. This is again as a consequence of

phosphorus pollution from livestock farming, abstraction by industry and construction work causing morphological alterations. North of its confluence with the Powgree Burn, the river is designated as a drinking water protection zone and according to a consultation response received from the Ayrshire Rivers Trust, also supports populations of salmon (protected under UK legislation), trout eels and sticklebacks. The importance of this receptor can therefore be classed as high.

15.3.5 There are further minor waterbodies in the study area that are not classified in RBMP terms by SEPA. These include the Bath and Mains Burns located between the western periphery of the town itself and running into the Kilbirnie Loch.

15.3.6 Additionally, there are five unnamed watercourses connected to the existing drainage network for the A737 (shown in Figure 15.2). Firstly there is a minor field drain which runs adjacent to Spier's Old School Grounds to the south of the scheme. This flows south and crosses Barrmill Road before joining with the Powgree Burn. The second of these is close to the A737 junction with Threepwood Road to the north of the scheme. This is culverted under the road and is assumed, with a high degree of confidence, to connect to an underground storm water drain which in turn connects up to the Mains or Bath Burns. The third watercourse is related to an area of low lying wetland approximately 200m north of the Wardrop Street junction and appears to act as a field drain. This is also culverted under the A737 and is likely to flow into the Mains or Bath Burn. For the fourth unnamed watercourse, a similar situation occurs opposite Larch Terrace, where drainage from the field flows under the A737 west, towards Kilbirnie Loch. Finally, an open storm water ditch runs from a point approximately 100m south of Manrahead roundabout, again to Kilbirnie Loch. It should be noted that although small and unclassified these watercourses are the primary means by which water is drained from the A737. In the face of limited information in relation to their characteristics professional judgement would indicate that these watercourses should be attributed a importance of medium, as they are likely to receive urban pollutants whilst passing under the town to the west.

Groundwater

15.3.7 British Geological Survey Maps (Ref 15.13) show much of the area covered by the scheme to be underlain by bedrock comprising of the Beith Lava Member. To the south of the scheme around Manrahead roundabout this changes to bedrock belonging to the Kirkwood formation, comprises of sedimentary volcanoclastic rock. There are also banded deposits of Blackhall Limestone, the Lower Limestone and the Hurlet Limestone

Formations south of Geilsland Road. Superficially, the geology is dominated by devansian till, formed in the in the Quaternary Period, with the addition of areas (north of Wardrop Street and Geilsland Road) of alluvial material, comprised of clay, silt, sand and gravel.

15.3.8 Investigation of BGS hydrogeological maps (Ref 15.14) show the scheme to lie in the vicinity of three distinct aquifer types. The north and central section of Beith is describes as being underlain by impermeable rocks, generally without groundwater, matching the geological character of the area described above. To the south of the scheme extents, around Manrahead roundabout, groundwater is described as comprising of highly productive aquifers (carboniferous Dinatian and Numarian) with flow likely to take place within fissures and discontinuities, again matching the change in geology described in paragraph 15.3.7. To the west of Beith, aquifers are considered to be concealed aquifers, with limited or local potential (Quaternary, coastal and river alluvium). The resolution of such maps however is limited.

15.3.9 The Groundwater Vulnerability Map of Scotland (Ref 15.15) records the site as being underlain by strata described as weakly permeable, comprising rock formations of generally low permeability that does not widely contain groundwater in exploitable quantities.

15.3.10 Scotland's Environment Maps show the scheme to be underlain by two groundwater bodies. The Dalry groundwater body (SEPA ID 150578) is classified by SEPA in 2014 as having an overall status of poor. Geoindex maps (Ref 15.16) class this as a moderately productive aquifer with low yields (up to 10L/s in places). The information sheet for this water body lists the Powgree Burn, Mains Burn, River Garnock and Kilbirnie Loch amongst its associated surface waters. The Beith groundwater body (SEPA ID 150588) is classified by SEPA (2014) as having an overall status of good. Geoindex maps describe small amounts of groundwater near the surface weathered zone and in secondary fractures. Up to 2 L/s can be obtained from rare springs. None of the associated surface waters listed in the information sheet for this waterbody are included within the surface water study area as described in paragraphs 15.3.1 to 15.3.6.

15.3.11 Consultation with Amey's geotechnical team in addition to interrogation of the latest Ground Investigation Report have confirmed that much of the superficial geology in the area can be described as relatively impermeable glacial till atop an impermeable basalt bedrock layer. Any groundwater encountered appears to have been present in alluvial deposits, occasionally close to the bedrock surface. These deposits are considered to be relatively static, with no discernible flow.

15.3.12 Ground investigations were undertaken across the site by Structural Soils on behalf of Amey. These recorded groundwater at various depths from 0.65m to 2.5m at numerous locations. This investigation is slightly limited however, given that no investigations were carried out around Manrahead Roundabout. Borehole and trial pit logs suggest that much of the water was present in sandy, gravely clay material, consistent with the alluvial superficial geology of the area. Additionally, the two alluvial areas identified by BGS maps were found to contain peat material, with significant water content.

15.3.13 These two areas (and likely to be larger in scale than those identified as alluvial by BGS), comprise marshy grassland, within an area west of Geilsland School and a larger area in the northern extent of the survey area, opposite Thomson of Beith Garage also have the potential to represent groundwater dependent habitats, however as described in paragraph 15.3.13, they have been scoped out of the assessment as a consequence of there being no clear ecological connectivity between the receptor and the scheme. They are therefore not considered to be groundwater dependent habitats.

15.3.14 The Drinking Water Quality Regulator for Scotland (DWQR) website (Ref 15.17) has also been reviewed for any Type A PWS in the area (supply on average more than 10m3 of water per day, or serve more than 50 people, or supply a commercial or public activity, regardless of volume). There are no Type A water supplies within 2km of the scheme, with the nearest being at Hoodsyard Farm, 2km north east from the scheme. In addition, the DWQR indicate that Beith is a Scottish Water public supply area.

15.3.15 The PWS have been scoped out of this assessment and are not considered further. However, it should be noted that neither the DWQR nor NAC list properties supplied by Type B PWS (domestic supplies providing less than $10m^3$ of water per day, or supplying less than 50 people) and that there are seven wells and two springs shown on OS maps within 2km of the scheme. Land owner Local landowners were not consulted on private water supplies, although consultations should be held at the detailed design stage to determine if these are PWS and their status.

15.3.16 In combination, review of the resources described in paragraphs 15.3.7 to 15.3.17 would suggest that groundwater in the bedrock of the area is limited, with inconsistent pockets of largely static superficial groundwater presenting themselves at various locations and depths. Little information is available in relation to groundwater around Manrahead roundabout, however it will be assumed that this is a moderately productive aquifer of poor quality, with flow taking place in fissures and discontinuities. Both of the aquifers

identified by Scotland's Environment are designated within drinking water protection zones, suggesting that there may be potential for potable water supplies.

15.3.17 Two receptors have been identified in order to carry out this assessment, consisting of groundwater in the vicinity of Manrahead roundabout and groundwater underlying the rest of the site. The importance of these receptors has been calculated using the parameters described in Table 15.3. This allows for various characteristics relating to quality, levels of use and dependant ecology to be taken into account. Based on the characteristics described above, groundwater in the vicinity of Manrahead roundabout is considered to be of medium importance, taking into account its inclusion within a drinking water protection zone, but also considering its poor quality and relatively low yield. Groundwater in superficial deposits across the rest of the site can also be considered to be of medium importance, given the apparent higher quality but lower volumes and exploitability.

Road drainage

15.3.18 Road drainage along the A737 is currently via a mix of drainage ditches and pipe-work which are in poor condition. Much of the water collected from the road surface discharges into fields off the southbound carriageway. There are numerous areas where the drainage system is overwhelmed and pooling occurs, particularly in the low points north of Wardrop Street and opposite Larch Terrace. It is thought that runoff finds its way into the unnamed drainage ditches and storm water drains outlined in the surface water section (paragraph 15.3.1 and 15.3.6), eventually flowing into either Kilbirnie Loch or the Powgree Burn.

15.3.19 An investigation was carried out utilising CCTV in May 2014 to assess the condition of the current drainage network. A substantial number of defects were identified across the drainage network within the study area, indicating a bad state of repair throughout, and much of the network was inaccessible. Some of the problems identified include various instances of fractured, cracked or collapsed pipes, infiltration of roots, displacement of pipe joints, obstruction and debris and various levels of encrustation and flooding. In several instances the survey had to be abandoned due to these defects and the levels of water in the pipes at the time of investigation. Manrahead Roundabout, Barrmill Road junction and Head Street/Wardrop Street junctions have been noted as having defects which severely reduce the effectiveness of the drainage in these areas.

15.3.20 Ultimately, information regarding the current drainage system and how it operates and interacts with local watercourses is limited, to the point where a HAWRAT assessment of baseline conditions is unlikely to be accurate. This in turn means that a quantitative comparison of baseline pollutant concentrations and post construction pollutant concentrations is not practical and has not been carried out.

Flooding

15.3.21 As part of the STAG Pre-appraisal process, consultations were undertaken with key stakeholders. Consultation was undertaken in two parts, firstly through 1-1 consultation with stakeholders and secondly through a stakeholder workshop. Stakeholder consultations identified flooding in the dip in the vertical alignment between Head Street and Barrmill Road as a particular problem.

15.3.22 This has been confirmed both by the CCTV surveys carried out in May 2014 and by SEPA's interactive flood mapping tool (Ref 15.10), which also shows that flooding from surface water is an issue in the area adjacent to the filling station, north of Wardrop Street.

15.3.23 SEPA flood maps also identify areas to the immediate north of Manrahead Roundabout as being susceptible to surface water flooding. Most notably, properties around McMillan Crescent are at high risk. The field on the opposite side of the A737 is similarly at high risk. A disused railway line runs along the northern edge of the housing estate to which McMillan Crescent belongs and is in cutting. Observation during numerous site visits has indicated that this area is regularly waterlogged.

15.3.24 The study area does not lie within North Ayrshire Council Flood Warning Area and is not at risk of either fluvial or tidal flooding.

15.4 Impact assessment

15.4.1 Although the methodology outlined in section 15.2 above does not allow for linkages between surface and groundwater to be taken into account in the assessment, it should be noted that it is possible that any pollution of a groundwater body has the potential to cause pollution to a surface water body, and vice versa. The Beith groundwater body in particular (as described in paragraphs 15.3.7 to 15.3.17) is linked to numerous surface water bodies within the study area.

Temporary impacts during construction

15.4.2 The nature of construction impacts does not allow for an assessment using HAWRAT, as this relies heavily on traffic information in order to assess the risk to the water environment. However, the potential impacts arising from construction are wide-ranging.

15.4.3 As with any construction site, accidental spillage will present a risk to the water environment through runoff and leaching. Leachate may also be derived from stockpiled materials. These may in turn contribute to windblown contaminants entering nearby watercourses.

15.4.4 Disturbance of contaminated material such as that thought to lie beneath the vicinity of Thomson of Beith Garage has the potential to contaminate groundwater in the short term.

15.4.5 Dewatering is unlikely to be required on site as the quantities of groundwater likely to be exposed are such that they will be catered for through standard construction site drainage (details of which can be found in the mitigation section).

15.4.6 The churning up of soils and mud within the site boundary may contribute to particles suspended in runoff. A similar issue may arise from track out produced by work vehicles, where contaminants will instead flow into the existing road drainage system, but still causing an increase in sediment loading in local watercourses.

15.4.7 Any contamination of waterbodies is likely to affect the flora and fauna dependent on the water environment. Suspended sediments can reduce the oxygen levels affecting fish and hazardous chemicals can cause plants and animals significant harm. The extent of the impact is dependent on factors such as the dilution capacity of the waterbody along with the levels and type of contaminants.

15.4.8 The inappropriate timing of groundworks or landscaping works may lead to increased levels of runoff, water logging of soils and contribute to land slip events or ineffectual seeding.

15.4.9 The DMRB methodology outlined in section 15.2 does not allow for the consideration of temporary impacts, however, in the absence of any mitigation the construction of the scheme has the potential to have a significant impact on both groundwater and surface water.

Permanent impacts post construction

Spillage risk

15.4.10 The risk of pollution from spillage, as Table 15.4 shows, is a contributory factor to the evaluation of the magnitude of impact on groundwater and surface water. The DMRB Volume 11, Section 3, Part 10 recommends that this assessment is carried out for the following five types of road (if present) within any given scheme:

- No junction
- Roundabout
- Side road
- Slip roads
- Cross roads

15.4.11 Table 15.6 shows the risk of pollution from spillage for surface waters. The resultant probability of a serious pollution incident (as shown in Appendix 15.1) overall is 0.0005%, which is well below the acceptable limit of 1%. For groundwater Table 15.7) this figure is 0.0002%. This is a result of a combination of factors including the lower than average proportion of HGVs, the high proportion of the scheme made up from "no junction" and the rural location of the A737.

Table 15.6: Spillage risk by road category for surface waters

Road Type	**No junction**	**Roundabout**	**Side road**
Threshold of acceptability for annual probability of a serious pollution incident (%)	1	1	1
Calculated annual probability of a serious pollution incident (%)	0.00012	0.00032	0.00005
Within acceptable limits (yes/no)	Yes	Yes	Yes
Threshold of acceptability for annual probability of a pollution incident (years)	1 in 100yr	1 in 100yr	1 in 100yr
Calculation of return period (years)	8,254	3,093	21,933
Within acceptable limits (yes/no)	Yes	Yes	Yes

Table 15.7: Spillage risk by road category for groundwaters

Road Type	No junction	Roundabout	Side road
Threshold of acceptability for annual probability of a serious pollution incident (%)	1	1	1
Calculated annual probability of a serious pollution incident (%)	0.00006	0.00016	0.00002
Within acceptable limits (yes/no)	Yes	Yes	Yes
Threshold of acceptability for annual probability of a pollution incident (years)	1 in 100yr	1 in 100yr	1 in 100yr
Calculation of return period (years)	16,508	6,187	43,867
Within acceptable limits (yes/no)	Yes	Yes	Yes

Impacts of routine runoff on surface water

15.4.12 There are four outfalls from four SuDS basins integrated into the scheme design, shown in Figure 15.2. Each of these basins outfall into minor unnamed and unclassified watercourses, whose flow is largely thought to be resultant from road drainage. Each of these outfalls is assessed using the Highways Agency Water Risk Assessment Tool (HAWRAT) but the pollution reduction capacity of the basins is not taken into account at this stage. This has been considered in the residual impacts section of this chapter in order to quantify the mitigative impact of the basins. The characteristics gained from site surveys have been used where possible. However, some information was not available and therefore the following assumptions have been made for all receiving watercourses:

- 95th percentile flow is assumed to equal the outfall rate from each of the SuDS basins (5l/s)
- The default figure for Base Flow Index is used (0.5)
- The default figure for Manning's number is also used, as this is thought to represent the channel characteristics as described in the DMRB Volume 11, Section 3, Part 10, Annex V

15.4.13 Environmental Quality Standards are taken from SEPA Supporting Guidance (WAT-SG-53): Environmental Quality Standards (EQS) and Standards for Discharges to

Surface Waters (Ref 15.18). This guidance does not refer to the concentrations of dissolved pollutants in freshwater (referred to in HAWRAT), but does provide "bioavailable" concentrations for each relevant pollutant. According to the guidance, "this is the fraction of dissolved, metal [that] has the potential to contribute to toxic effects in aquatic animals or plants". Therefore, if the dissolved concentrations predicted by HAWRAT are below these levels, then the water quality can be deemed to have more than met the relevant EQS standards. Table 15:8 provides a summary of the predicted pollutant concentrations produced by HAWRAT.

15.4.14 Additionally, pollutant concentrations have been compared against Runoff Specific Thresholds (RSTs). These provide an indication of the impact resulting from short term (6 hour and 24 hour) exposure of organisms to pollutants. Table 15.9 below provides 6 and 24 hour RSTs for both copper and zinc, supplemented by the number of allowable exceedances and the number of predicted exceedances for each outfall at step 2. Detailed results can be found in Appendix 15.1.

Table 15.8: HAWRAT Step 2 outputs for the impacts of routine runoff on surface water

Outfall No.	Level of detail in assessment	HAWRAT annual average concentrations (µg/l)		EQS (bioavailable in freshwater) (µg/l)		Pass under EQS	Depositional index (DI)	Impacts of sediment deposition within acceptable limits
	Tier 1 or Tier 2	Dissolved copper	Dissolved Zinc	Bioavailable Copper	Bioavailable Zinc	Yes/No		Yes /No
Outfall 1	Tier 1	0.13	0.41	1	11.9	Yes	18.95	Yes
Outfall 2	Tier 1	0.28	0.88			Yes	46.61	Yes
Outfall 3	Tier 1	0.1	0.29			Yes	45.66	Yes
Outfall 4	Tier 2	0.29	0.89			Yes	No DI provided at Tier 2 by HAWRAT	Yes

Table 15.9: Compliance with runoff specific thresholds

Outfall No.	**Copper**				**Zinc**			
	RST24 = 21 µg/l		RST6 = 42 µg/l		RST24 = 60 µg/l		RST6 = 120 µg/l	
	No. of allowable exceedance per year	No. of predicted exceedance per year	No. of allowable exceedance per year	No. of predicted exceedance per year	No. of allowable exceedance per year	No. of predicted exceedance per year	No. of allowable exceedance per year	No. of predicted exceedance per year
Outfall 1	2	0	1	0	2	0.2	1	0
Outfall 2		0		0		0.4		0.1
Outfall 3		0		0		0		0
Outfall 4		0		0		0.4		0

15.4.15 Based on the HAWRAT results detailed in Table 15.8, and the spillage risk assessed in Table 15.6, it is considered that the magnitude of impact of the scheme on surface water is negligible. This is because the HAWRAT shows that all outfalls pass for both soluble and sediment bound pollutants across a mix of tier 1 and tier 2 assessments. Given that the receiving watercourses in each case are considered to have a medium importance based on a lack of information relating to their quality, the significance of the likely impact on them is neutral according to the methodology set out above. Taking this into account the significance of any impact on waterbodies downstream such as the Powgree Burn, Bath Burn, Mains Burn, Kilbirnie Loch or River Garnock is similarly neutral.

15.4.16 However, as discussed in the limitations section of this chapter (paragraphs 15.8.1 to 15.8.4), the methodology does not allow for positive impacts to watercourses to be identified, as no HAWRAT assessment can be carried out for baseline conditions. It is likely however that there will be a noticeable improvement in the quality of water reaching the receiving watercourses, as the current system has water quality treatment capacity and no capability to the control the outfall rate (although this is less of a issue given the minimal pluvial flood risk in the area as described in paragraph 15.2.18).

Impacts on groundwater

15.4.17 An area of peat at the north of the site, close to where the new carriageway ties into the old, will be compressed using a drainage blanket, allowing water in the area to be retained, rather than de-watered.

15.4.18 Groundwater was also struck at depths of 0.75m and 1m either side of the newly aligned Wardrop Street. This section of side road will be slightly embanked with interaction with groundwater in the area likely to be limited as a result.

15.4.19 Groundwater was also identified a depths varying from 1m to 2.5m in the low lying peaty area to the west of Geilsland School. This is a visibly wet area, through which the new alignment will run directly towards a new roundabout at Barrmill Road. It is anticipated that some of the peat in this area will be excavated but, where possible, some will be retained and compressed using a drainage blanket prior to the installation of road pavement. Any groundwater within this area will be lost as a result of excavations (although not likely to be of sufficient quantity for dewatering), and again given the limited groundwater flow of these limited deposits, any impact on quality beyond the footprint of the excavations will be negligible.

15.4.20 Groundwater was also encountered at various points in the vicinity of where the new Barrmill Roundabout will be constructed, particularly to the north east. Depths vary from 0.7m to 2.2m. Impacts in this area are likely to be minimal as again this section of the scheme is likely to be constructed at, or above the current level. The case is likely to be similar where groundwater was encountered where the new alignment crosses Barrmill road south and a section of the new Barrmill Road.

15.4.21 A section of the carriageway between the new Barrmill roundabout and the modified Manrahead roundabout will be in cutting. Although ground investigation in this area indicated no groundwater, pits were only dug to a maximum depth of 4.2m (often prevented from progressing due to bedrock) with the exception one borehole south of the dismantled railway, which was bored to a depth of 8.5m and showed no signs of groundwater.The maximum depth of excavations is expected to be approximately 5.5m. Therefore it is possible, although unlikely, that groundwater may be struck, below the depth of ground investigation, while excavations are being carried out.

15.4.22 Manrahead roundabout will be extended southwards. Any new sections of pavement or roundabout will be above or equivalent to their existing level. Therefore interaction with any groundwater in the area will be minimal and unlikely to produce any permanent impacts.

15.4.23 Across the site generally, it is possible that where excavations do encounter a pocket of groundwater, this portion of the resource will be lost on a permanent basis. The quantities of groundwater involved are small however, to the point where dewatering is unlikely to be required during construction.

Risk of impact of routine runoff on groundwater

15.4.24 As outlined in paragraph 15.2.15, the assessment of the impact of routine runoff on groundwater requires a number of inputs, or components, including traffic density, rainfall, soakaway and information on the geological baseline. These are described in paragraphs 15.5.25 to 15.5.28 along with an indication of the level of risk associated with each factor.

15.4.25 Traffic levels on the A737 are far below 50,000 vehicles (two-way flow) per day, which means that the risk to groundwater is low. Average annual rainfall for this area, as recorded by the Meteorological Office (Ref 15.19) is between 1,700mm and 2,200mm per year for the region for the period 1981-2010, which produces a high risk factor.

15.4.26 Soakaway geometry is comprised of filter drains and grass-lined gullies, part of a drainage design agreed in principal with a representative of SEPA on 1st October 2015. According to Table 15:10 this means the risk factor should be between medium and low in this instance. Taking a precautionary approach, the risk has been assigned as medium. Ground water strikes, as discussed in the baseline paragraphs 15.3.12 to 15.3.13, have ben experienced at depths shallower than 5m and a high risk is assigned, in the absence of further detail on the depth of the water table.

15.4.27 As described in Chapter 10, superficial geology in the area is derived largely from glacial till, with clay, silt, sand and gravel common throughout. There are also a number of peaty areas to the north of Wardrop Street and around the Barrmill Road junction; particularly in the depression to the north of Geilsland Road. The area is also mostly underlain by igneous Basalt, although an area around Manrahead roundabout is more likely to be underlain by sedimentary rock. The approximate average proportions of clay, silt, sand, gravel and cobbles from across the site are shown in Table 15:10.

Table 15.10: Borehole/trial pit sample make-up

Material type	Clay	Silt	Sand	Gravel	Cobbles
Mean proportion encountered in borehole/trial pit samples (%)	13.9	23.6	28.9	28.7	4.9

15.4.28 The proportion of material made up from clay is between 1% and 15%, giving a risk of medium, while the grain size is best categorised as "fine sand and below", as 62.6% of the material is sand silt or clay. Groundwater flow in the area is thought to be limited in the area, with isolated pockets of groundwater evident in alluvial material and peat at various locations across the site. Borehole records indicate that groundwater flow if any is likely to be intergranular. Superficial geology and the likelihood of superficial groundwater deposits are relatively consistent across the entirety of the site, including the area around Manrahead roundabout to the south. However, it is thought that this area may be underlain by the Dalry bedrock aquifer, where groundwater flows are described as taking place within fissures and discontinuities. Therefore the risk assigned to flow type for this area can be categorised as consolidated deposits (ie mixed fracture and intergranular flow).

15.4.29 These inputs have been applied to the matrix represented by Table 15.11. Each input or component has been given a risk score according to the scale of the given parameter. A weighting is then applied depending upon the influence of each of the components for each of the two groundwater receptors identified (in accordance with the DMRB Volume 11, Section 3, Part 10). The components shaded in grey represent those which are applicable to the scheme.

Table 15.11: Impact of routine runoff on groundwater north of Manrahead roundabout

Input		Weighting	Property	Low risk (score 1)	Medium risk (score 2)	High risk (score 3)
1	SOURCE	15	Traffic density	<50,000 AADT	≥50,000 to <100,000 AADT	≥100,000 AADT
2		15	Rainfall volume (annual average)	<740mm rainfall	740-1060mm	>1060mm rainfall
3	PATHWAY	15	Soakaway geometry	Continuous linear (eg ditch, grassed channel)	Single point, or shallow soakaway (eg lagoon) serving low road area	Single point, deep serving high road area (>5,000m^2)
4		20	Unsaturated zone	Depth of water table >15m and unproductive strata	Depth to water table >5m, but <15m	Depth to water table <5m
5		20	Flow type	Unconsolidated or non-fractured consolidated deposits (ie dominantly intergranular flow)	Consolidated deposits (ie mixed fracture and intergranular flow)	Heavily consolidated sedimentary deposits, igneous and metamorphic rocks (dominated by fracture porosity)
6		7.5	Effective grain size	Fine sand and below	Coarse sand	Very coarse sand and above
7		7.5	Lithology	<1% clay minerals	>1% but <15% clay minerals	>15% clay minerals

Table 15.12: Impact of routine runoff on groundwater around Manrahead roundabout

Input		Weighting	Property	Low risk (score 1)	Medium risk (score 2)	High risk (score 3)
1	SOURCE	15	Traffic density	<50,000 AADT	≥50,000 to <100,000 AADT	≥100,000 AADT
2		15	Rainfall volume (annual ave.)	<740mm rainfall	740-1060mm	>1060mm rainfall
3	PATHWAY	15	Soakaway geometry	Continuous linear (eg ditch, grassed channel)	Single point, or shallow soakaway (eg lagoon) serving low road area	Single point, deep serving high road area (>5,000m2)
4		20	Unsaturated zone	Depth of water table >15m and unproductive strata	Depth to water table >5m, but <15m	Depth to water table <5m
5		20	Flow type	Unconsolidated or non-fractured consolidated deposits (ie dominantly intergranular flow)	Consolidated deposits (ie mixed fracture and intergranular flow)	Heavily consolidated sedimentary deposits, igneous and metamorphic rocks (dominated by fracture porosity)
6		7.5	Effective grain size	Fine sand and below	Coarse sand	Very coarse sand and above
7		7.5	Lithology	<1% clay minerals	>1% but <15% clay minerals	>15% clay minerals

15.4.30 Using the categories assigned in Table 15.12 and taking into account the stated weighting for the various elements of the assessment, a risk score of 177.5 is generated for groundwater north of Manrahead roundabout, which according to the DMRB Volume 11, Section 3, Part 10 Annex I, means that the groundwater in the area is at medium risk of impact. For the section of the scheme south of this point, the risk score is slightly higher (197.5), although the risk is still considered to be medium.

15.4.31 Overall, with reference specifically to groundwater north of Manrahead roundabout, there may be some loss to small isolated pockets of groundwater in superficial deposits. The groundwater in question is understood not to be of sufficient quantity to represent a productive aquifer and there are no designated ecological sites dependent upon groundwater in the area and no known private or commercial supplies drawn from it. Removal of peat, and the water it contains will be minimised with the use of compression and surcharge methods. As described in paragraph 15.4.30 above, the risk to groundwater in this area has been calculated to be medium with the risk of spillage <1%. Therefore, according to Table 15.4 (taken directly from DMRB Volume 11, Section 3, Part 10, Annex IV) the magnitude of the impact on groundwater predicted in this area is minor. This, when coupled with a resource importance of medium, results in an impact significance of slight.

15.4.32 Groundwater to the south of this, around Manrahead roundabout, is similarly important, by virtue of its greater productivity but lower quality. Groundwater in this area is unlikely to be affected on a permanent basis as the design of the junction itself will at this point be very similar to the existing layout, with the addition of an improved drainage system coupled to a SuDS basin. The risk to this groundwater body is slightly higher than elsewhere however, with different flow characteristics apparent in the underlying bedrock aquifer, but spillage risk will remain similarly low (<1%). Therefore an impact magnitude of minor can be attributed, generating an impact significance of slight.

15.4.33 However, a significant proportion of this assessment is derived from the calculation of risk. The methodology described in DMRB does not allow for a positive, neutral or negligible effect to be attributed where a risk score has been calculated. With respect to this scheme, it is likely that a small volume of largely unusable and relatively unimportant groundwater north of Manrahead roundabout may be lost on a permanent basis, with limited influence on the quality of the remaining resource. The impact significance of slight adverse for this resource is therefore considered appropriate.

15.4.34 For groundwater south of this however, an impact significance of neutral would seem more appropriate, as interactions with groundwater are unlikely. The significance of slight assessed above (paragraph 15.4.32) is generated largely as a result of the risk associated with the new road. However the assessment methodology does not allow for a comparison between existing and new groundwater risk. If this were to be carried out, it would show either no change, or an improvement, by virtue of improved drainage infrastructure. Therefore an impact significance of neutral should be assigned to this groundwater receptor.

15.5 Mitigation measures

During construction

15.5.1 The following mitigation measures will be put in place during construction:

- A Construction Environmental Management Plan should be produced, along with an erosion prevention and sediment control plan
- Spill kits should be strategically placed throughout the site in areas where spillages are likely to occur, reducing the risk to the receiving water environment
- Fuel and oil should be stored appropriately and in line with The Water Environment (Oil Storage) (Scotland) Regulations 2006, in order to reduce the risk of spillage and contamination
- Any other hazardous chemical should also be stored appropriately and securely in line with the Control of Substances Hazardous to Health Regulations 2002 (Ref 15.20)
- Where small plant are in use, appropriate temporary bunds (or plant nappies) should be used during operation and especially when refuelling
- A wheel washing station should be established, ensuring that all runoff is captured and attenuated/filtered before re-entering the water environment
- Where practical, settlement and recirculation systems should be installed for water reuse to minimise water use and the potential for pollution
- A contained area should be provided for washing out of vehicles and plant, including concrete batching plant and cement mixers

- Wash waters should be collected and, where necessary and appropriate, discharge into foul sewers (with the consent of Scottish Water). Where not appropriate, these should be disposed of off-site.
- An area of hard standing should be maintained to reduce the potential for track out and soil compaction and the contamination of runoff with soil/silt. For the same reasons appropriate surfacing should be applied to well used routes within site.
- Materials and wastes should not be stockpiled; to avoid the possibility of suspended particles in runoff. Where this is not possible stockpiled materials should be appropriately covered.
- It is anticipated that temporary SuDS basins will be used on site while construction is taking place, with a system temporary pipework, gullies and ditches to manage surface or groundwater on site derived from run-off, peat surcharge or small volumes of groundwater exposed by excavation.
- Silt netting should be erected where there is a risk of contaminated runoff entering any watercourse.
- Consultation with SEPA must take place prior to works commencing. Such a consultation is likely to precipitate the need for a licence under the Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended (Ref 15.6). The granting of such a licence will depend on, in part, a review of method statement relating particularly to dewatering exercises or excavations. Any conditions or recommendations imposed by the licence should be strictly adhered to.
- The following relevant Pollution Prevention Guideline (PPGs) should also be adhered to (Ref 15.21):
  - PPG1: general guide to the prevention of pollution
  - PPG2: Above ground oil storage
  - PPG 4: Treatment and disposal of sewage where no foul sewer is available
  - PPG 5 Works and maintenance near water
  - PPG 6 Working at construction and demolition sites
  - PPG8 safe storage and disposal of used oil
  - PPG18 Managing fire water and major spillages
  - PPG21 Pollution incident response planning
  - PPG22 Dealing with spillages on highways
  - PPG26 Safe storage – drums and intermediate bulk containers

- CIRIA Guidance: Control of water from construction sites. Guidance for consultants and contractors (C532) should be referred to for planning site drainage (Ref 15.22)
- All potentially polluting activities should be undertaken at least 10 metres from any watercourse or surface water drains, in order to reduce the risk of runoff and consequent contamination of watercourses.

Post construction

15.5.2 Although, integrated fully into the design, the four SuDS basins represent the only notable post construction mitigation measure. The basins will be used to treat surface water runoff from the carriageway and improve the quality of the water discharged to the receiving watercourses and have been designed in accordance with the SuDS for Roads Guidance (published in 2010 as a result of a collaboration between the SuDS Working Party and the Society of Chief Officers of Transportation in Scotland) (Ref 15.23) and the CIRIA SuDS Manual (C753) (Ref 15.24). They will be fed by a system of filter drains and grass ditches and have been designed to reduce the concentration of soluble metals in runoff by 43% and reduce the concentration of soluble poly-aromatic hydrocarbons by 60% (relevant calculations are shown in Appendix 15.2). Where HAWRAT is concerned, the lower of these proportions is used in the assessment. The use of the basins as part of the drainage system will also lead to a 15% reduction in annual sediment with a discharge rate of 5l/s. For the purposes of this assessment, SuDS basins have been considered to be dry basins, however, at the specific request of SEPA the basins will maintain some moisture at all times and may be lined with clay or an artificial membrane depending on the make-up of the surrounding soil. Ultimately this means that they will fall somewhere in-between the categorisation of dry basin and wet treatment pond. The basins will be planted with vegetation appropriate to the conditions and have the potential to provide new habitats for local wildlife.

15.6 Residual impacts

During construction

15.6.1 The mitigation measures set out in paragraphs 15.5.1 to 15.5.2 are expected to reduce the temporary impacts during construction. However, detail relating to the scheduling, layout and methods likely to be used in construction is limited at this stage, and largely at the discretion of the chosen contractor. If the mitigation measures outlined in paragraph 15.5.1 are effectively implemented, residual impacts resulting from construction will be minor in magnitude and slight in significance.

Post Construction

15.6.2 As noted in paragraph 15.5.2, the only mitigation measures for the water environment to be included as part of the scheme are SuDS basins. Tables 15.13 and 15.14 show the concentrations of dissolved pollutants and the pass/fail status of sediment bound pollutants for each outfall where SuDS basins are taken into account.

Table 15.13: Residual impacts of routine runoff on surface water

Outfall number	**Level of detail in assessment**	**HAWRAT annual average concentrations (µg/l)**		**EQS (bioavailable in freshwater) (µg/l)**		**Pass under EQS**	**Depositional index (DI)**	**Impacts of sediment deposition within acceptable limits**
	Tier 1 or Tier 2	Dissolved copper	Dissolved Zinc	Bioavailable Copper	Bioavailable Zinc	Yes / No		Yes /No
Outfall 1	Tier 1 + Step 3	0.08	0.23	1	11.9	Yes	16.11	Yes
Outfall 2	Tier 1 + Step 3	0.16	0.5			Yes	39.62	Yes
Outfall 3	Tier 1 + Step 3	0.05	0.17			Yes	38.81	Yes
Outfall 4	Tier 2 + Step 3	0.16	0.51			Yes	No DI provided at Tier 2 by HAWRAT	Yes

Table 15.14: Residual impacts on compliance with runoff specific thresholds

Outfall No.	**Copper**				**Zinc**			
	RST24 = 21 µg/l		RST6 = 42 µg/l		RST24 = 60 µg/l		RST6 = 120 µg/l	
	No. of allowable exceedances per year	No. of predicted exceedances per year	No. of allowable exceedances per year	No. of predicted exceedances per year	No. of allowable exceedances per year	No. of predicted exceedances per year	No. of allowable exceedances per year	No. of predicted exceedances per year
Outfall 1	2	0	1	0	2	0	1	0
Outfall 2		0		0		0.1		0
Outfall 3		0		0		0		0
Outfall 4		0		0		0.1		0

15.6.3 Estimated reductions of dissolved pollutants are show in Table 15:15 below, where a pass with respect to sediment impact has been maintained for each outfall.

Table 15.15: Reductions in dissolved copper and zinc concentration

Outfall No.	Reduction in dissolved copper (µg/l)	Reduction in dissolved Zinc (µg/l)
Outfall 1	0.05	0.18
Outfall 2	0.12	0.38
Outfall 3	0.05	0.12
Outfall 4	0.13	0.38

15.6.4 Spillage risk will also be reduced due to the inclusion of SuDS, with the total combined probability of a pollution incident for surface waters reducing to 0.0003% and the return period increasing to 3,401 years. For groundwater the risk reduces to 0.0001% with return period of 6,803 years.

15.6.5 Despite these clear reductions, the significance of changes to routine runoff caused by the scheme will still be, according to the methodology set out in paragraph 15.2.10 to 15.2.14, neutral. It is likely however that there will be a marked improvement in water quality in the area as a result of the inclusion of SuDS in the design.

15.6.6 Similarly, as described in paragraph 15.6.6, the methodology for groundwater assessment finds that an impact of slight significance will be experienced for both groundwater bodies assessed. However, groundwater to the south of the scheme is unlikely to be disturbed and the new layout of Manrahead roundabout will be similar to the existing junction. North of this, some groundwater will be lost. However, only small quantities ae expected to be encountered, belonging to a groundwater body of very limited productivity and importance. The significance of any permanent impacts on groundwater around Manrahead roundabout is therefore likely to be neutral. Where small quantities of groundwater are lost (which cannot be mitigated against) the residual impact significance is considered to be slight adverse. This conclusion supports the opinion offered by SEPA that there are unlikely to be any significant impacts on groundwater as a result of the scheme.

15.7 Statutory and planning context

15.7.1 Legislation, policies and plans relevant to water environment are outlined in Table 15.16, along with an indication of whether the scheme meets the objectives.

Table 15.16: Statutory and planning context

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
Scottish Planning Policy , Managing Flood Risk and Drainage (2014) (Ref 15.2)	Promotes: The use of the precautionary principal in relation to all types of flood risk, whilst accounting for the effect of climate change. The safeguarding of flood storage and conveyancing, whilst locating future development away from functional floodplains Where required, the assessment of flood risk, flood protection, restoration of natural features, enhance capacity. Avoidance of constructing new culverts, where existing ones can be opened.	The local authority has advised that a flood risk assessment need not be carried out. The scheme will incorporate improvements to numerous pre-existing culverts in order to tie drainage into the existing system.	Y
Scotland The Hydro Nation, Prospectus	The policy relates to the water industry in Scotland on a strategic level. However, included as part of this is	The use of SuDS will reduce impacts related to any diffuse	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
and Proposals for Legislation 2012 (Ref 15.3)	an emphasis on a pro-active approach to catchment management in order to reduce diffuse pollution.	pollution through attenuation.	
The Water Environment and Water Services (Scotland) Act 2003 (Ref 15.4)	The Water Framework Directive (WFD) (2000/60/EC) was introduced by the European Parliament in 2000 in order to establish systems to manage and protect the water environment. It was transposed into Scots Law by the Water Environment and Water Services (Scotland) Act 2003 (WEWS). In 2015 this was further amended to incorporate provisions stipulated within the Groundwater Directive (2008/118/EC). This legislation essentially requires the quality of inland, estuarine and coastal watercourses as well as groundwater deposits to attain a status of "good". The date for final compliance is 2027.	The scheme has the potential to positively influence the quality of watercourses in the surrounding area on both a short and long term basis due to the implementation of an upgraded drainage system.	Y
The Water Environment (Oil Storage) (Scotland) Regulations 2006	These regulations control the storage of oil and oil products, and regulate the storage of products such as petrol and diesel for the purposes of the protection of the water environment.	All fuels and oils will be stored in accordance with the Act.	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
(Ref 15.5)			
Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 as amended (Ref 15.6)	These regulations outline the need for various levels of consent required for potentially polluting activities carried out in or near water.	Numerous road construction activities which will be carried out as part of the scheme will require registration or licencing, including possible dewatering, work on culverts and the installation of SuDS basins. This will be carried out in accordance with the conditions set out in the relevant CAR licence.	Y
Flood Risk Management (Scotland) Act 2009 (Ref 15.7)	This instrument requires the preparation and review of flood risk assessments, flood hazard and flood risk maps and flood risk management plans as well as local flood risk management plans, to be prepared through collaboration of SEPA and local authorities.	The Flood Risk Management Strategy prepared for the relevant local plan district has been reviewed. Beith does not lie within a "potentially vulnerable area" and as such will not be subject to any	Y

Legislation / Plan / Policy	Description	Relevance to scheme	Achieves objectives? (Y/N)
		objectives in relation to flood management.	
North Ayrshire Local Development Plan, Policy PI8: Drainage, SuDS and Flooding (Ref 15.25)	This policy sets out the conditions which new developments must meet in relation to water/waste-water, SuDS and flooding.	The conditions in relation to water supply and waste-water are not relevant to the scheme. Consultation has been undertaken with the local authority Flood Risk Management Officer, with the drainage strategy deemed satisfactory. Four SuDS basins have been incorporated into the schem design while the local authority has also indicated that a Flood Risk Assessment need not be carried out.	Y

15.8 Limitations

15.8.1 Basic data underpinning HAWRAT was generated in England, and as such its appropriateness to Wales, Scotland and Northern Ireland many be reduced. The tool is also limited where stream flows are seasonal or intermittent.

15.8.2 There was limited availability of technical information regarding surface watercourse, particularly relating to flow rate. The assessment is carried out on the assumption that the outfall rate from the SuDS basins represents a reasonable reflection of the 95th percentile figure for the receiving watercourse. In this context, it is important to take into account that, "the reliability of the 95th percentile flows must be considered carefully as representative measures of low flow. The values should be used with caution in view of the problems associated with both the measurement of very low discharges and the increasing proportional variability between natural flow and artificial influences, such as abstractions, discharges and storage changes as the river flow diminishes" , as stated in DMRB Volume 11, Section 3, Part 10, HD45/09.

15.8.3 With respect to groundwater, estimations and assumptions, based on available information, have been made in relation to flow characteristics, water quality and productivity, particularly to the south of the scheme where ground investigations were not as extensively carried out. This has the potential to limit the accuracy of the assessment of potential impacts of the scheme on groundwater.

15.8.4 Although CCTV surveys were carried out, the existing road drainage system and the way in which it interacts with drainage in the surrounding farmland is not well understood. This has limited the extent to which a quantitative assessment of pollutants can be undertaken. Consequently the methodology applied allows for either an adverse or neutral impact, as a beneficial impact requires a comparison of pre and post construction HAWRAT results.

15.9 Conclusion

15.9.1 In conclusion, the impact of routine runoff resulting from the scheme on surface water will be neutral for each receiving watercourse. This conclusion has been reached using the DMRB methodology set out in paragraphs 15.2.10 to 15.2.14. As described however, this methodology is limited in its ability to assign beneficial impacts due to the uncertainty and lack of information available regarding the existing drainage network. The inclusion of SuDS basins at four locations is likely to improve the quality of water

entering the relevant watercourses and control discharge from the road drainage network more effectively and within certain flow limits (5l/s).

15.9.2 The impact of routine runoff from the scheme on groundwater will be neutral for groundwater in the vicinity of Manrahead roundabout and slight adverse for groundwater resources to the north of this.

15.9.3 Where flooding is concerned NAC have been consulted during the development of the drainage design, and are content with the proposals. They have indicated that a FRA is not required. The drainage system for the scheme has been designed to capture all runoff from the new road, attenuate this runoff within SuDS basins and control the outfall of the runoff into local watercourses. The scheme therefore is unlikely to pose any additional risk to local flooding issues.

16 Interactions and Cumulative Impacts

16.1 Introduction

16.1.1 This Chapter considers whether there are likely to be any cumulative impacts from the scheme, either individually or in combination with other projects. At individual topic level, the impact on a receptor may be assessed as non-significant however, when the impacts from each topic on a single receptor are considered in combination, the resulting cumulative impact may be significant. Cumulative impacts result from multiple actions on receptors and over time, are generally additive or interactive (synergistic) in nature. Cumulative impacts can also be considered as impacts resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the scheme. The assessment of cumulative impacts is based on the DMRB Volume 11 Section 2 Part 5 HA 205/08, Assessment and management of Environmental effects (ref 16.1) with additional guidance provided by Interim Advice Note 125 /09 Supplementary guidance for users of DMRB Volume 11 'Environmental Assessment' (ref 16.2).

16.2 Methodology

16.2.1 Cumulative impacts were considered on a locational and/or receptor basis, for example the potential for a cumulative impact on a residential receptor to occur due to both traffic noise and land-take, or a cumulative impact on a watercourse affected at various reaches and/or by changes to both ecological and hydrological conditions.

16.2.2 There are two types of cumulative impacts described by the DMRB Volume 11 Section 2 Part 5 that can arise from a project or development:

- impacts from several developments, which individually might be insignificant, but when considered together could amount to a significant cumulative impact
- impacts resulting from the combined effects of individual impacts resulting from the development programme, for example noise, dust and visual impacts, from the proposed development on a particular receptor

16.2.3 In the European commission guidance "Guidelines for the Assessment of Indirect and Cumulative effects and Impact Interactions" (Ref 16.3), cumulative effects are defined as "Impacts that result from incremental changes caused by other past, present, or reasonably foreseeable action together with the project" for example:

- Incremental noise from a number of separate developments

- Combined effect of individual impacts, eg noise, dust and visual, from one development on a particular receptor
- Several developments with insignificant impacts individually but which together have a cumulative impact

Assessment of impact

16.2.4 Paragraphs 4.3.27 to 4.3.28 in Chapter 4 provide details of the methodology for assessing cumulative impacts including Table 4.5 Determination of cumulative impact significance.

16.3 Cumulative impacts of the scheme in combination with other projects

Local projects

16.3.1 A review of North Ayrshire Council's Planning portal website (Ref 16.4) has found that there are four proposed developments within Beith as follows:

- Erection of 46 dwelling houses including the formation of associated roads, footpaths and open spaces - Site To Northwest Of 37 Auldlea Road Beith Ayrshire; ref. no: 15/00720/pp, received date: 27 November 2015, status: approved subject to conditions, case type: planning application.
- Formation of 5 serviced house plots and associated access roads - Site to northwest of 30 Glebe Road Beith Ayrshire, Ref. No: 15/00733/PP, received date: 04 December 2015, status: approved subject to conditions, case type: planning application.
- External alterations, installation of replacement windows/doors/signage, repainting and the erection of a 2 storey rear extension to include the demolition of existing single storey extension - 45 Eglinton Street Beith Ayrshire KA15 1AB; Ref. No: 15/00731/PP, received date: 03 December 2015, status: approved subject to conditions, case type: planning application.
- Alterations, installation of replacement windows/doors/signage, repainting and the erection of a 2 storey rear extension to include the demolition of existing single storey extension - 45 Eglinton Street Beith Ayrshire KA15 1AB; Ref. No: 15/00732/LBC, received date: 03 December 2015, status: approved subject to conditions, case type: planning application.

16.3.2 It is considered that these parallel developments will not have a cumulative impact with the scheme as they are not in close proximity to the scheme, the nearest development,

lying 210m northwest (at its closest point) of the current A737, and their impacts, eg increased traffic numbers or construction noise, are not considered to be significant. In line with Table 4.5, they have been assessed as being not significant as receptors in the area which has the capacity to absorb any cumulative impacts.

National projects

16.3.3 The S-Paramics traffic modelling described in Chapter 2 The Project and Alternatives Considered, was used to identify the impact of the scheme on traffic numbers and assess noise and air quality impacts. The A737 / A738 Dalry Bypass, which has been granted Scottish Ministers' approval to proceed, was included within the core scenarios in all forecast years to predict the cumulative impact of both schemes on traffic numbers, noise and air quality. The results of the modelling have been included in their relevant chapters in this report.

16.3.4 The proposed improvements at A737 The Den, to the south of Beith, were not considered to influence traffic behaviour and therefore had no cumulative impacts the scheme.

16.4 Cumulative impacts of the scheme on receptors

Temporary impacts during construction

16.4.1 Construction of the scheme will involve considerable disruption to a number of residential properties, including:

- Properties 1-12 Wardrop Terrace
- Properties 18-20 Wardrop Road
- Properties at 12, 14, 16, 45 Barrmill Road
- Property at 2 Spiersland Way

16.4.2 The cumulative impacts likely to affect these properties during construction include emissions of dust, construction noise, visual intrusion, temporary changes in amenity and increased journey length for NMUs. It is considered that these impacts are likely to have a cumulative impact with moderate significance.

16.4.3 Although the mitigation measures stated in Chapter 6 Air Quality, Chapter 8 Landscape Effects, Chapter 12 Noise and Vibration Chapter 13 Effects on all Travellers and Chapter 14 Community and Private Assets, will reduce the individual impacts, the cumulative impact will remain significant.

Permanent impacts post construction

16.4.4 Similarly, there are a number of residential properties that may experience cumulative impacts during the operation of the scheme even although impacts on individual environmental topics are not assessed as significant. The cumulative impacts on these properties with the scheme in place with mitigation are set out in Table 16.1.

Table 16.1: Assessment of cumulative impacts

Receptor	Impact
12 and 14 Barrmill Road	• Small decrease in NO_2 , $PM_{2.5}$ and PM_{10} in the short and long term • Short term noise affecting the east façade is slight beneficial impact and the west façade is large beneficial • Long term noise affecting the east façade is slight beneficial impact and the west façade is large beneficial • Very large adverse visual impacts in year 1 after opening • Large adverse effect visual impacts in year 15 after opening
16 Barrmill Road	• Small increase in NO_2, $PM_{2.5}$ and PM_{10} in the short and long term • Short term noise affecting the south east façade is large adverse and the south west façade are large beneficial impact • Long term noise affecting the south east façade is moderate adverse and the south west façade is large beneficial impact • Very large adverse visual impacts in year 1 after opening • Large adverse effect visual impacts in year 15 after opening • Slight adverse impact from loss of small area of garden
45 Barrmill Road	• Small increase in NO_2, $PM_{2.5}$ and PM_{10} in the short and long term • Short term noise affecting the north façade is moderate beneficial impact and the east façade is large beneficial • Long term noise affecting the north façade is slight beneficial and the east façade is moderate beneficial impact • Very large adverse visual impacts in year 1 after opening • Large adverse effect visual impacts in year 15 after opening • Large significant impact on journey length for NMUs • Slight adverse impact from loss of small area of garden
2 Spiersland Way	• Small increase in NO_2, $PM_{2.5}$ and PM_{10} in the short and long term • Short term noise is slight beneficial

Receptor	Impact
	• Long term noise is slight beneficial • Very large adverse visual impacts in year 1 after opening • Large adverse effect visual impacts in year 15 after opening • Large significant impact on journey length for NMUs
18 – 20 Wardrop Road	• Small increase in NO_2, $PM_{2.5}$ and PM_{10} in the short and long term • Short term noise affecting the north façade short is slight beneficial impact and the south façade is moderate adverse • Long term noise affecting the north façade is slight beneficial and the south façade is slight adverse • Moderate adverse visual impacts in year 1 and year 15 after opening • Slight beneficial impact on journey length for NUMs

16.4.5 In relation to Table 4.5 Determination of cumulative impact significance, it is considered that the cumulative impacts on these properties from the scheme are likely to be of moderate significance.

16.4.6 Although the mitigation measures stated in Chapter 6 Air Quality, Chapter 8 Landscape Effects, Chapter 12 Noise and Vibration Chapter 13 Effects on all Travellers and Chapter 14 Community and Private Assets, will reduce the individual impacts, the cumulative impact will remain significant.

17 Schedule of Environmental Commitments

17.1 Introduction

17.1.1 This chapter provides a summary of the environmental commitments that are described within each environmental topic in the Environmental Statement (ES). All mitigation measures identified are necessary to help protect the environment prior to or during construction of the scheme. These measures will be incorporated into the contract documents along with construction method statements and the contractor's environmental management system.

17.1.2 The assessment of the scheme identified a number of potentially significant environmental impacts that could arise both during construction, and as a permanent impact of the scheme. Mitigation measures have been identified to minimise and control these potentially significant impacts.

17.1.3 The purpose of the Schedule of Environmental Commitments is to collate the mitigation measures identified throughout the ES for ease of reference. The following factors are included:

- A description of the mitigation measure
- The objective of the mitigation
- The location and timing of the mitigation
- Any monitoring requirements

17.1.4 The Schedule of Environmental Commitments will be incorporated into the construction contract documentation and the contractor will be obliged to adhere to these requirements throughout the duration of the contract. The construction commitments will be addressed through a Construction Environmental Management Plan (CEMP).

17.1.5 The method statements, environmental management system and the ES provide the mechanisms to ensure compliance with environmental commitments.

Table 17.1: Schedule of environmental commitments

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
Air Quality					
AQ 1	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary	To ensure all site staff are aware of who to contact regarding any air quality issues	This should be made available within the site compound	The Environmental Clerk of Works (ECoW) must ensure this is displayed for the duration of the works	N/A
AQ 2	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions	To minimise and control the generation of dust particles from construction activities	DMP must be developed prior to construction and implemented during the construction phase	The ECoW to carry out regular site inspections to ensure compliance with DMP	N/A
AQ 3	Record all dust and air quality complaints and ensure the complaints log is available to Local Authority	To identify causes and take appropriate measures to reduce emissions in a timely manner	Whole site during the construction phase	Monitored by the ECoW	N/A
AQ 4	Undertake daily on-site and off-	To minimise and	Whole site during the	Monitored by the ECoW	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	site inspection, where receptors (including roads) are nearby, to monitor dust and record inspection results	control the generation of dust particles from construction activities	construction phase	and included within relevant method statements and CEMP	
AQ 5	Plan site layout so that machinery and dust causing activities are located away from receptors	To minimise and control the generation of dust particles from construction activities	Whole site during the construction phase	Monitored by the ECoW and included within relevant method statements and CEMP	N/A
AQ 6	Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site	To minimise and control the generation of dust particles from construction activities	All areas where dusty activities are planned	Monitored by the ECoW and included within relevant method statements and CEMP	N/A
AQ 7	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction	To minimise the generation of dust particles from construction activities	All equipment used which is likely to generate dust	Monitored by the Environmental Clerk of Works (ECoW) and included within relevant method statements and CEMP. Monitoring	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
				frequency should be increased during periods of dry or windy weather	
AQ 8	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process	To minimise the generation of dust particles from aggregates drying out	All areas where stockpiles are located during the construction phase	Monitored by the Environmental Clerk of Works (ECoW) and included within relevant method statements and CEMP. Monitoring frequency should be increased during periods of dry or windy weather	N/A
AQ 9	All exposed stockpiles onsite which are likely to generate dust must be dampened down as and when required	To minimise the generation of dust particles from construction activities	All areas where stockpiles are located during the construction phase	Monitored by the Environmental Clerk of Works (ECoW) and included within relevant	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
				method statements and CEMP. Monitoring frequency should be increased during periods of dry or windy weather	
AQ 10	All vehicles carrying materials which are likely to generate dust on and off site should have covered or sheeted bodies	To minimise the generation of dust particles from vehicle movements on site	All vehicles entering and exiting the site during the construction phase	Monitored daily by the ECoW and included within relevant method statements and CEMP	N/A
AQ 11	A wheel wash facility will be located on site to remove any loose material before the vehicle enters the local road network	To minimise the generation of dust particles from vehicle movements off site	Site exits and additional designated washing facility areas as provided during the construction phase	Monitored by the ECoW Pollution Prevention Guideline (PPG): 13 Vehicle washing and cleaning should be adhered to	N/A
AQ 12	Site vehicles will utilise specific haul routes at all times, these	To minimise the generation of dust	Specific haul routes within the whole site	Monitored daily by the ECoW and included	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	routes must be dampened and swept down regularly. A water assisted dust sweeper on roads should be utilised	particles from vehicle movements on and off site	during the construction phase	within relevant method statements and CEMP	
AQ 13	Activities which have the potential to generate large volumes of dust should be avoided in weather conditions likely to generate dust, such as high winds	To prevent or minimise dust generated on site	Whole site and during the construction phase	Monitored by the ECoW and included within relevant method statements and CEMP	N/A
Cultural Heritage					
CH 1	All site operatives will be made aware of cultural heritage assets during the site induction, especially the location of possible medieval or post-medieval settlement and agricultural remains	To minimise the likelihood of disturbing or damaging unrecorded archaeological sites	Whole site, during the construction phase. Sites 40 and 41 which falls within the scheme extents between Barrmill Road and Manrahead	Details provided within the relevant method statement and CEMP	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
			Roundabout (Refer to Figures 7.1 and 7.2)		
CH 2	An archaeological trial trench/pit is required to be undertaken prior to construction commencing	Identify, investigate and record archaeological features or artefacts	Selected areas where excavation is required Sites 40 and 41 which falls within the scheme extents between Barrmill Road and Manrahead Roundabout (Refer to Figures 7.1 and 7.2)	To be agreed once trial trench is undertaken	Any further mitigation measures arising from trial trench will need to be agreed with WoSAS
CH 3	Noise, dust and light pollution control measures should be put in place	To minimise the impacts upon the settings of cultural heritage resources that are of high or	Geilsland School (site 6) and the entrance to Spier's School (site 14). Refer to Figure 7.1.	Monitored by ECoW. Details provided within the relevant method statement and CEMP	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
		medium sensitivity			
CH 4	Public access should be maintained to the locations of cultural heritage resources that are of high or medium sensitivity	These are of high importance to the people of the local area, who use these as amenity resources, places of leisure and enjoyment.	Grounds, designed landscape and listed elements of the former Spier's School (sites 14, 30 and 37)	Monitored by ECoW. Details provided within the relevant method statement and CEMP	N/A
Landscape Effects					
LE 1	All landscape work to be supervised by Chartered Landscape Architect	To minimise unnecessary disturbance to landscape	Whole site during construction	Monitored by the Landscape Clerk of Works (LCoW). Details to be included in relevant method statements and CEMP	N/A
LE 2	Where significant specimen trees are to be retained in close proximity to the construction	To preserve biodiversity and reduce visual impact	Where specific specimen trees are to be retained (Refer to	Monitored by the LCoW Details to be included in relevant method	Landscape Clerk of Works

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	works, Root Protection Areas (RPA) will be calculated and established in accordance with BS5837: 2012 Trees in relation to design, demolition and construction – Recommendations. The protection areas will be adhered to and no plant, machinery or construction materials will be stored within these areas.		Landscape Design Drawing 25000199/100/166)	statements and CEMP	
LE 3	Disposal of ash Fraxinus species should be in accordance with The Forestry Commission guidance	To prevent the spread of ash dieback *Chalara fraxinea*	All sites to be impacted by the scheme where ash species are present (Refer to Landscape Design Drawing 25000199/100/166)	Monitored by the LCoW Details to be included in relevant method statements and CEMP	Landscape Clerk of Works

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
LE 4	The loss of mature trees should be remedied by replacement planting of semi-mature trees of a similar species on a 2:1 basis	To provide replacement woodland habitats	During construction at various locations along the scheme (Refer to Landscape Design Drawing 25000199/100/166)	Monitored by the LCoW Details to be included in relevant method statements and CEMP	Landscape Architect
LE 5	The works entrance and site compound should be located out with the village of Beith	To minimise disruption to the character of the village	Works entrance and site compound, construction phase	Details to be included in the relevant method statement	N/A
LE 6	Keep plant and HGVs out of the village as far as practically possible and designated haulage routes should be used	To minimise disruption to the village	Whole site and during the construction phase	This should be monitored by the site manager and the LCoW	N/A
LE 7	Designated spoil heaps and material storage areas should be identified	To minimise visual intrusion of works to local residents and vehicle travellers	Whole site and during the construction phase	This should be monitored by the site manager and the LCoW	N/A
LE 8	The removal of vegetation	To minimise effects on	Whole site during the	Monitored by the LCoW	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	should be minimised where possible	biodiversity, landscape character and sensitive views	construction phase		
LE 9	Similar tree and shrub species found in the surrounding landscape should be used	To assist in the assimilation and integration of the scheme	Whole site during the construction phase where planting is required (Refer to Landscape Design Drawing 25000199/100/166)	Monitored by the LCoW. Details to be included in the relevant method statement	
LE 10	The stone walls which run along Wardrop Street will be reinstated along the proposed Wardrop Street alignment	To ensure the character of the area is preserved and reduce visual impact on sensitive receptors	Specific locations at Wardrop Street (Refer to Landscape Design Drawing 25000199/100/166)	Monitored by the LCoW. Details to be included in the relevant method statement	N/A
LE 11	Ensure that no materials or vehicles are located on the grass verge	To preserve the soil structure and vegetation	Whole site and during the construction phase	Monitored by the LCoW. Details to be included in the relevant method	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
				statement	
LE 12	Careful consideration must be given to the final location of new sign posts	To avoid close proximity to trees/shrubs which may cause root damage	Various locations throughout the site where posts are required	Monitored by the LCoW. Details to be included in the relevant method statement and CEMP.	N/A
LE 13	Field fragmentation will be mitigated through the reinstatement and/or creation of field boundaries such as fencing and hedgerow. This will be dependent on land ownership	To ensure no boundaries are lost during construction	Specific fields impacted by the works, throughout the scheme (Refer to Landscape Design Drawing 25000199/100/166)	Monitored by the LCoW. Details to be included in the relevant method statement and CEMP.	Landowners
LE 14	Additional woodland and vegetation will be planted	To screen the scheme from all visual receptors which will experience an impact	Various locations including receptors 7, 8, 9 and 10 (Refer to Landscape Design Drawing	Monitored by the LCoW. Details to be included in the relevant method statement and CEMP.	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
			25000199/100/166)		
LE 15	Screening fencing and earth bunds will be installed where the proposed A737 passes visual receptors 7-10	To screen the scheme from all visual receptors which will experience an impact	Receptors 7, 8 9 and 10	Monitored by the LCoW. Details to be included in the relevant method statement and CEMP.	N/A
LE 16	New lighting along the proposed road alignments will be designed in accordance with the DMRB, Volume 8, Section 3; Design of Road Lighting for the Strategic Motorway and all Purpose Trunk Road Network (TD34/07). Lighting on the proposed roundabouts will be designed in accordance with DMRB, Volume 6, Section 2; Geometric Design of Roundabouts (TD34/07) Guidance from The Institution of	To soften the impact of new lighting on visual receptors	Detailed design for whole scheme	N/A	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	Lighting Professionals will also be followed in relation to the extents of the lighting that should be provided at conflict areas				
LE 17	Lighting will be directional and will be kept to a minimum in line with health and safety requirements. Where possible, new lighting will not be sited outside residential receptors where lighting is not currently present	To reduce light pollution of adjacent properties	Various locations, detailed design	N/A	N/A
LE 18	Strategic mitigation planting will take place in the vicinity of receptors 5, 7, 8, 9, 10, 24 and 25	To soften the impact of new lighting on visual receptors	Receptors 5, 7, 8, 9, 10, 24 and 25 (Refer to Landscape Design Drawing 25000199/100/166)	Monitored by the LCoW. Details to be included in the relevant method statement and CEMP.	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
Ecology and Nature Conservation					
ENC 1	Category 1 tree will not be removed. If the design changes to require removal, an EPS licence may be required for bats following further surveys.	To avoid affecting roosting bats	Tree located south of Spier's Old School Ground, refer to Figure 1, Appendix 9.3	Monitored by contractor and ECoW. Details to be included in the relevant method statement and CEMP	N/A
ENC 2	Planting of trees and hedgerows in specific locations where bats have been found	Reinstatement of foraging routes to provide navigation points for bats	Various locations within the scheme extents, refer to Landscape Design Drawing 25000199/100/166	Monitored by contractor and ECoW. Details to be included in the relevant method statement and CEMP	N/A
ENC 3	The construction of four SuDS basins as part of the scheme design	The basins are designed to maintain a lever of water retention all year round, therefore replacing some of the	Four locations within the scheme extents, Refer to Landscape Design Drawing 25000199/100/166	Monitored by contractor and ECoW. Details to be included in the relevant method statement and CEMP	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
		lost marshland during construction			
ENC 4	At night, any open excavations and pipes should be covered over	To avoid injury to wildlife	Whole site where trenches and ditches are present during construction	Monitored by contractor and ECoW. Details to be included in the relevant method statement and CEMP	N/A
ENC 5	Artificial lighting used on site during the works should be sympathetic to the rural surroundings	To avoid unnecessary disruption to wildlife in the wider area	These should be used during any night works throughout the construction site while work is ongoing. Avoid roost entrances so as not to impact emergence behaviour	Monitored by contractor and ECoW. Details to be included in the relevant method statement and CEMP	N/A
ENC 6	Lighting hoods should be fitted directing the light only to the working area	To avoid light splaying into surrounding areas causing disruption to	Where artificial lighting is required, during construction	Monitored by contractor and ECoW. Details to be included in the relevant	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
		wildlife		method statement and CEMP	
ENC 7	Best practice techniques, outlined within British Standard 5228-1:2009: Code of practice for Noise and Vibration Control on Construction and Open Sites	To minimise disruption to wildlife caused by noise and vibration	Whole site and during the construction phase	Monitored by contractor and ECoW. Details to be included in the Noise and Vibration method statement and CEMP	Noise specialist
ENC 8	Vegetation clearance to be undertaken between March and August (outwith the bird breeding season). All areas where vegetation removal is required must be checked for the presence of bird nests	To prevent disturbance to nesting birds	Where vegetation removal is to take place, prior to construction	Monitored by contractor and ECoW. Details to be included in the relevant method statement and CEMP	N/A
Geology and Soils					
GS 1	Soil or other materials excavated and requiring disposal off-site will need to be characterised and	To ensure all waste is properly disposed of in compliance with all	Whole site and during the construction phase	Monitored by the ECoW. Details to be included in the relevant method	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	disposed of in accordance with the Landfill (Scotland) Amendment Regulations 2003	Duty of Care obligations		statement and CEMP	
GS 2	Development of Site Waste Management Plan (SWMP) during detailed design	Maximise use of existing resources and reduce waste	Whole site during detailed design	Monitored by ECoW. Details to be included in the relevant method statement and CEMP	N/A
GS 3	Development of Materials Management Plan (MMP)	To allow Waste Characterisation Analysis to maximise the quantities of soil material recycled	Whole site during detailed design	Monitored by ECoW. Details to be included in the relevant method statement and CEMP	N/A
GS 4	Stripped topsoil should be stored in a manner to allow it to be re-used in the final works	To allow maximum re-use of soil on site	Whole site and during the construction phase	Monitored by the ECoW. Details to be included in the relevant method statement and CEMP	N/A
GS 5	A Ground Gas Monitoring Program should be produced	To allow for gassing issues to be assessed	Detailed design stage	Monitored by the ECoW. Details to be included in	

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
		in accordance with CIRIA 665		the relevant method statement and CEMP	
GS 6	Land owner consultations should be held to determine the locations and status Private Water Supplies	To determine the impact on PWS of cuttings	Detailed design stage	Monitored by ECoW	Hydrogeologist
GS7	Additional ground investigation including soils and groundwater sampling	To define the CSM and produce reuse criteria protective of the environment and human health in accordance with SEPA's Land remediation and waste management guidelines based on the principles that the reuse of the soil will	Detailed design stage	Monitored by ECoW	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
		not result in pollution of the environment (particularly the water environment) or harm to human health			
GS8	Appropriate health and safety and waste management procedures for working with potentially contaminated soils should be established	To reduce the risk from contaminated land	Whole site and during the construction phase	Monitored by ECoW	N/A
GS9	A 'watching brief' should be enforced during construction in order to take account of the fact that there may be isolated pockets of previously unidentified contamination. Once identified areas of contaminated land would be demarcated both	To reduce the risk from contaminated land	Whole site and during the construction phase	Monitored by ECoW	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	in the field and in drawings so that excavated material can be handled separately from greenfield. In addition access to areas identified as contaminated should be restricted during construction				
GS10	Dust generation should be controlled through damping-down with clean water during dry and/or windy periods	To control windblown dust and to prevent wind erosion	Whole site and during the construction phase	Monitored by the ECoW. Details to be included in the relevant method statement and CEMP	N/A
GS11	Haul routes should be no wider than necessary to accommodate two passing vehicles and should be stripped of soil down to a firm base. Indiscriminate vehicle movements across soil should be avoided	To control windblown dust and to prevent erosion	Whole site and during the construction phase	Monitored by the ECoW. Details to be included in the relevant method statement and CEMP	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
GS12	Soils should be stored according to guidelines given within the 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites'	To prevent soil mixing, wastage and prevent surface water runoff and to prevent erosion	Whole site and during the construction phase	Monitored by the ECoW. Details to be included in the relevant method statement and CEMP	N/A
GS13	All fuel and chemical storage areas should be on hardstanding and be bunded to prevent leaks escaping to the soils environment.	To prevent pollution of soils, geology, surface waters, aquifers and groundwaters	Whole site and during the construction phase	Monitored by the ECoW. Details to be included in the relevant method statement and CEMP	N/A
Materials					
M1	A Site Waste Management Plan, a Materials Management Plan and a Soils Resource Plan will be produced for the scheme as part of the CEMP, which shall also include methods of material procurement to ensure the most	To maximise the amount of material for reuse, to reduce the amount of waste and to reduce the impact of using virgin sources of material.	Whole site and during the construction phase	Monitored by the ECoW. Documents to be included in the CEMP and as they will be live documents, regularly reviewed.	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	suitable materials with lowest impacts are used in the construction of this scheme eg the use of carbon management tools.				
Noise and Vibration					
NV 1	Earth bunds and barriers are proposed along the A737, both sides of the carriageway	To minimise the noise levels post construction	Earth bund at Wardrop Street – starts at Chainage 450 to 480, at a height of 1.5m at a 1 in 3 slope. Southbound direction travelling from Barrmill: 1. An earth bund starts at Chainage 925 to 980 at a maximum height of 2.5m.		Noise specialist

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
			2. A retaining wall and noise barrier 2.5m in height will run from Chainage 980 to Chainage 1085 where it will overlap with the earth bund which will taper back up to 2.5m at Chainage 1085. 3. From Chainage 1185 to 1180 the earth bund will remain at a constant height of 2.5m. At Chainage 1180 the earth bund will taper down to 1.5m to Chainage 1200. From Chainage		

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
			1200 to 1280 the earth bund will remain at a constant height of 1.5m, whilst tapering down to ground level at Chainage 1280 to 1300. Northbound direction from Manrahead: 1. At Chainage 1120 to 1040 a 2.5m barrier at a height 2.5m will run where it overlaps with retaining wall at Chainage 1040 (approximately 1m in height, at road level) with a 2.5m barrier on		

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
			top to Chainage 950. 2. An earth bund tapers up from a height of zero at Chainage 950 up to full height of approximately 3.5m above roundabout level. The earth bund starts at Chainage 950 along the new A737 and ends Chainage 80 along Barrmill Road West route. Refer to Figure 12.8 and 12.10		
NV 2	Procedure in place for	To ensure any	Pre-construction	Monitored by the ECoW.	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	complaints which will detail site managers contact details. A complaints register must be available to detail the complaint, date and time.	complaints are dealt with in an efficient manner	briefing to be carried out to all staff working onsite. Procedure must be available within the site compound	Further details will be included within relevant method statements and CEMP.	
NV 3	Any movement of vehicles, plant and machinery should be undertaken during normal operating hours	To minimise the risk of disturbance to local residents	Whole site during the construction phase	Monitored by the ECoW. Further details will be included within relevant method statements and CEMP.	N/A
NV 4	Operatives should receive training to effectively employ techniques to reduce site noise. This includes minimising noise levels when using radios/phones provided to aid communication across the site	To raise awareness to operational staff of disruption to sensitive receptors	Pre-construction briefing to be carried out to all staff working onsite	Site noise should be monitored daily, especially during anti-social hours. This level of noise will be agreed prior to construction with NAC and will be included in contract	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
				specification	
NV 5	Use best practicable means of noise control, as described within BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Noise, and BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites – Vibration	To minimise the risk of disturbance to local residents	Whole site during the construction phase and during periods of heavy construction	Monitored by a noise specialist during agreed intervals. Details to be included with relevant method statement and CEMP	Noise specialist
NV 6	Noise levels should be monitored through regular noise assessments during works	To minimise noise and vibration levels generated on site that may disrupt to sensitive receptors	Whole site during the construction phase	Monitored by a noise specialist during agreed intervals. Details to be included with relevant method statement and CEMP. Further details of locations will be	Noise specialist.

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
				determined at detailed design stage, when further information of available with construction methods.	
NV 7	Appropriate mufflers and silencers should be fitted to machinery which should be positioned as far away as possible from noise sensitive receptors	To minimise noise and vibration levels generated on site that may disrupt to sensitive receptors	Whole site during the construction phase. 12 Barrmill Road and properties at Wardrop Street.	Monitored by the ECoW. Further details will be included within the relevant method statement and CEMP	N/A
NV 8	Vehicles must not idle needlessly, and all equipment must be switched off when not required	To reduce fuel use, carbon emissions and noise levels in the surrounding area	Whole site and during the construction phase	Monitored by the site supervision team and contractor	N/A
NV 9	All plant must be well-maintained and service documentation available for	To ensure all equipment is operating correctly and	Whole site and during the construction phase	Monitored by the site supervision team and contractor	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	inspection	efficiently			
NV 10	Best practice techniques, outlined within BS 5228-1:2009+A1:2014: Code of practice for noise and vibration control on construction and open sites	To minimise noise and vibration levels generated on site that may disrupt to sensitive receptors	Whole site and during the construction phase	Monitored by the ECoW. Details to be included in the relevant method statement and CEMP	North Ayrshire Council.
NV 11	The local community should be informed in advance of noise-generating works	To ensure high levels of communication with sensitive receptors and minimise the risk of works being delayed or stopped	Whole site, pre-construction and construction	Monitored by site supervisor and ECoW	Local media may require consultation
Effects on all Travellers					
ET 1	Advanced signage should be used during the construction period	To alleviate drivers stress	Whole scheme during construction	Monitored by site supervisor and ECoW	Local media
ET 2	Alternative routes should be	To ensure NMUs from	Whole scheme during	Monitored by site	Local media

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	made available for NMUs	Beith and Gateside can access facilities throughout the construction period	construction	supervisor and ECoW	
ET 3	Appropriate scheduling of noisy/dusty works, with the inclusion of dust screens or noise barriers where practicable.	To mitigate factors leading to reduction in amenity for NMUs using routes close to the works area.	Points at which NMUs and site likely to interact, during construction only.	Monitored by site supervisor and ECoW	N/A
Community and Private Assets					
CPA 1	Ongoing communication between the contractor and those affected by the scheme is essential	To ensure those affected have a point of contact and are up to date with works programme	Residents affected by the scheme throughout the construction process	Monitored by the contractor	N/A
CPA 2	Land owners to be informed of any intention to carry out work on their land in advance of the	To enable farmers to adapt their cultivation patterns accordingly	Pre-construction throughout the scheme	Monitored by the contractor	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	works				
CPA 3	Community land should remain accessible where possible	To minimise disruption to local residents	Whole site during the construction phase Land adjacent to Larch Terrace. Refer to Figure 13.1	Monitored by the ECoW. Details to be included in the relevant method statement and CEMP	Local media may be informed of any possible disruption
CPA 4	Exchange land to be provided for loss of open space.	To ensure open space is retained.	Post-construction	Monitored by the contractor	Consultation with local authority likely to be required.
CPA 5	Detail of accommodation works to be agreed with relevant landowners with respect to relevant issues such as drainage, access and boundaries.	To ensure minimal disruption to land use patterns.	Post construction, where accesses, drainage or boundaries likely to be affected by the scheme.	Monitored by the site supervision team and contractor	Consultation with landowners likely to be ongoing.
Road Drainage and the Water Environment					

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
RD 1	The construction of four SuDS basins as part of the scheme design, designed according to appropriate guidance manuals.	Treat surface water runoff from the carriageway and improve the quality of the water discharged to the receiving watercourses	Four locations within the scheme extents (Refer to Landscape Design Drawing 25000199/100/166)	Monitored by ECoW and detailed within the CEMP.	N/A
RD 2	Consultation with SEPA in regards to any licence required under the Water Environment (Controlled Activities) (Scotland) Regulations 2011	Minimise the potential for pollution to enter Powgree Burn and other minor watercourses	Specific sites where watercourses are located (Refer to Figure 15.1)	Monitored by ECoW and detailed within the CEMP. Adhere to licence if one is required	SEPA
RD 3	Hazardous chemicals should be stored appropriately and securely in line with the Control of Substances Hazardous to Health Regulations 2002	To reduce the risk of a pollution event	Designated supervised areas and during the construction phase	Monitored by ECoW and detailed within the CEMP.	N/A
RD 4	Designated area for wheel wash	Minimise the potential	Designated area onsite	Monitored by ECoW and	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
	and washing of vehicles and plant	for pollution		detailed within the CEMP	
RD 5	Refuelling of plant will take place within designated supervised areas at least 10m from any drain or watercourse	To reduce the risk of a pollution event	Designated supervised areas and during the construction phase	Monitored by the site supervision team: PPG 1 General guide to the prevention of pollution. PPG 6 Working at construction and demolition sites. Requirements can be found in the relevant method statement and CEMP.	N/A
RD 6	Adherence to appropriate pollution control procedures from SEPA, in particular pollution prevention guidelines	To reduce the risk of a pollution event onsite	Watercourses within the scheme extents and downstream, refer to Figure 15.1	Requirements can be found in the relevant method statement and CEMP. PPG 5, 6, 8, 18,	N/A

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
				21 and 22.	
RD 7	Fuel tanks will be double-skinned and will be bunded	To reduce the risk of a pollution event onsite. This will capture any fuel runoff before entering a local watercourse	At site compound and any fuel storage areas within the scheme extents	Monitored by the site supervision team. Further information within relevant method statement and CEMP	N/A
RD 8	Appropriate spill kits will be available on site and must be a suitable size to deal with significant spillages of fuel	To reduce potential for spillages to cause a pollution event	Whole site and during the construction phase	Monitored by ECoW. Further details within the relevant method statement and CEMP	N/A
RD 9	The Contractor shall produce a Construction Environmental Management Plan (CEMP), which will describe the specific procedures to be put in place	To control the sediment mobilisation, surface water discharges, and spillages	Watercourses within the scheme extents and downstream of these, refer to Figure 15.1	Monitored by the contractor	The contractor's method statement for dealing with sediment mitigation

Item	Mitigation Measures	Objective of Mitigation	Location and Timing of Mitigation Measures	Monitoring Requirements	Potential Additional Consultation Required
					would require to be accepted by SEPA
RD 10	Temporary SuDS basins with a system temporary pipework, gullies and ditches to manage surface or groundwater on site derived from run-off, peat surcharge or small volumes of groundwater exposed by excavation.	To ensure pollution from construction drainage system is appropriately mitigated against.	During construction	Monitored by ECoW and contractor.	Consultation with SEPA required for specification and requirements under Controlled Activities Regulations.

18 Summary and Conclusions

18.1.1 This chapter presents a summary of the permanent environmental impacts that are likely to arise from the scheme along with concluding comments.

18.2 Summary of temporary and permanent impacts

18.2.1 Table 18.1 presents a summary of the main predicted temporary permanent environmental impacts, taking into account mitigation measures applied. All mitigation measures have been identified in the previous chapters and are considered necessary to protect the environment during construction, on completion or during the maintenance of the scheme. These measures have been incorporated into the Schedule of Environmental Commitments in Chapter 17 which will be included in the Contract documents. This will provide a mechanism to ensure compliance with environmental commitments during construction and on completion of the scheme.

Table 18.1: Summary of temporary and permanent impacts

ES topic	Impact description	Residual impact significance
Air quality	Dust effects from construction Human health of PM_{10}	Negligible to low
Cultural heritage	Impacts on two receptors at Spier's School (sites 14 and 30), on the Geilsland School building (site 6) and the non-designated designed landscape at Spier's School (site 37)	Slight adverse to slight beneficial
	Disruption to historic setting	
Landscape effects	Temporary visual intrusion of construction machinery	Very large adverse to moderate beneficial
	Loss of amenity planting during construction	
	Loss of landcover post construction	
	Disturbance to tranquillity post construction	
	Visual impact of scheme on:	

ES topic	Impact description	Residual impact significance
	• receptors lying in close proximity with views of the scheme • views impacted by new street lighting and new road infrastructure	
Ecology and nature conservation	Habitats	Not significant to slightly beneficial
	Protected Species	Not significant
Geology and soils	Impacts to superficial and bedrock geological deposits and to soils comprising loss of soil matter (eg bio-data, carbon dioxide, soil structure), loss of geological structure, soil compaction or from covering soil with impermeable materials Complete pollutant pathway from contaminated land, with the primary pollutant pathway risk from migration of ground gas	Temporary and permanent impacts of slight significance to geology Low to moderate risks from contaminated land
Materials	Main materials use will be construction materials used in the construction of the scheme The main sources of waste will be soils that cannot be reused on site and organic waste from site clearance	Permanent, negative and direct for material use for materials use; Moderately adverse for waste disposed of at landfill and minor adverse for waste either reused on site or taken to a materials reclamation centre
Noise and vibration	Change in noise levels during construction	Significant adverse
	Change in noise levels during operation	Large / very beneficial – Slight adverse

ES topic	Impact description	Residual impact significance
Effects on all travellers	Improvement of visibility and sightlines; driver stress levels; journey length; Journey amenity	Large adverse to large beneficial
Community and private assets	Loss of community land, residential land and agricultural land	Neutral to very large adverse
Road drainage and the water environment	• Impact of routine runoff on surface water • Quality of water • Impact on groundwater	• Neutral • Beneficial • Neutral to slight

18.3 Conclusions

18.3.1 With the adherence to pollution prevention measures and the mitigation measures as set out in the Schedule of Environmental Commitments, construction impacts from the scheme should be reduced but will remain significant. Cumulative impacts likely to be experienced during construction include emissions of dust, construction noise, visual intrusion, temporary changes in amenity and increased journey length for NMUs.

18.3.2 Once in operation, no significant impacts will be experienced in relation to air quality, cultural heritage, ecology and nature conservation, landscape character and road driange and the water environment.

18.3.3 Significant beneficial impacts will be experienced in relation to all travellers and this is due to the reduction in driver stress and improvement in journey times and amenity.

18.3.4 Significant beneficial and adverse impacts are experienced with regards to views and noise and vibration. The impacts from both are directly linked to the location of the receptor in relation to the scheme, ie those located close to the scheme experience the largest adverse impacts, with those properties located furthest from the scheme experiencing the greatest beneficial impact. The majority of receptors experience beneficial impacts in relation to noise and vibration with a few isolated properties to the east of the existing A737 experiencing adverse impacts.

18.3.5 Significant adverse impacts will be experienced in relation to materials from waste generated during the construction of the scheme, geology and soils from the potential

risk of encountering contaminated land and to community and private assets due to the required land-take.

19 References

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1.2 DEPARTMENT FOR TRANSPORT, "Design Manual for Roads and Bridges Volume 11 Section 2 Part 6 reporting of environmental impact assessments" (HA48/08) http://www.standardsforhighways.co.uk/dmrb/vol11/section2/hd4808.pdf

2.1 HMSO, *Disability Discrimination Act 2005* available from www.legislation.gov.uk/ukpga/2005/13/contents

2.2 TRANSPORT SCOTLAND, *Roads for All*, as amended July 2013, available from www.transport.gov.scot/guides/j256264-00.htm

2.3 HMSO, The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011, available from www.legislation.gov.uk/uksi/2011/1824/pdfs/uksi_20111824_en.pdf

2.4 THE SCOTTISH GOVERNMENT, *Planning Advice Note (PAN) 1/2013: Environmental Impact Assessment*, August 2013, available from www.gov.scot/Publications/2013/08/6471

2.5 TRANSPORT SCOTLAND, *Analysis of Instantaneous Road Emissions User Manual*, Transport Scotland, June 2011 available from www.sias.com/2013/TS/AIREInstallationGuidanceJune11.pdf

2.6 DEPARTMENT FOR TRANSPORT, *DMRB Volume 12 Traffic Appraisal of Roads Schemes*, available from www.standardsforhighways.co.uk/ha/standards/DMRB/vol12/index.htm

2.7 TRANSPORT SCOTLAND, Transport Model for Scotland 2012, available from www.transport.gov.scot/latis/national-transport-and-land-use-models

4.1 DEPARTMENT FOR TRANSPORT, "*Design Manual for Roads and Bridges Volume 11 Environmental Assessment,*" http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/index.htm, accessed 10 November 2015

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4.3 DEPARTMENT FOR TRANSPORT, IAN 125/15 "*Supplementary Guidance for Users of DMRB Volume 11*." October 2015

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