9 Terrestrial Ecology

This chapter considers the potential impacts of the proposed scheme on terrestrial species, habitats and ecosystems. The approach to this assessment is based on Design Manual for Roads and Bridges (DMRB) guidance (Volume 11, Section 3, Part 4: Ecology and Nature Conservation 1993), including DMRB Interim Advice Note 130/10 'Ecology and Nature Conservation: Criteria for Impact Assessment', and draws on the Chartered Institute for Ecology and Environmental Management's (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland (2018).

Baseline conditions for terrestrial ecological features were established through a desk-based assessment, consultation and site surveys. This process identified nine ecological features that could potentially be impacted by the proposed scheme. These included three designated sites: The Firth of Forth Special Protection Area (SPA), Ramsar and Site of Special Scientific Interest (SSSI). In addition, terrestrial species that could potentially be impacted are wetland birds, bats, breeding birds, otter and peregrine.

Assessment of impacts and their significance of effect took into account the nature and magnitude of potential impacts and their consequent effects on important ecological features. Prior to the application of mitigation, potential significant effects on ecological features were identified for the construction and operation phases of the proposed scheme.

A hierarchical approach to mitigation was followed to address potential impacts. Where avoidance of impacts has not been possible, mitigation to reduce significant effects has been identified. Measures include the implementation of commitments and best working practices during the construction phase of the proposed scheme. A replacement artificial otter holt will be constructed to replace one lost as a result of the proposed scheme.

The saltmarsh temporarily lost under the raised working platform will be subject to measures to aid recovery once the platform has been removed, and the existing National Vegetation Classification (NVC) community is predicted to re-establish in the long-term. It is anticipated that there will be no significant residual effects as a result of construction or the operation of the proposed scheme.

9.1 Introduction

9.1.1 This chapter presents the Ecological Impact Assessment (EcIA) for the A985 Kincardine Bridge Refurbishment: Piled Viaduct Replacement scheme (hereafter referred to as the proposed scheme) which considers the potential impacts on terrestrial species, habitats and ecosystems.

9.1.2 The chapter is supported by the following appendices and figures, which are cross referenced where relevant:

- Appendix A9.1 (Species Names);
- Appendix A9.2 (Detailed Methods and Baseline Data);
- Appendix A9.3 (Confidential Ecology Features);
- Appendix A9.4 (Outline Ecological Management Plan (EMP))
- Figure 8.1 (Designated Sites);
- Figure 9.1 (Bird Survey Area);
- Figure 9.2 (Phase 1 Habitat Survey Results);
- Figure 9.3 (Bat Survey Results);
- Figure 9.4 (Through The Tide Count Survey Results);
- Figure 9.5 (Goose Roost Survey Results);
- Figure 9.6 (Breeding Bird Survey Results);

- Figure 9.7 (Confidential - Otter Survey Results); and
- Figure 9.8 (Confidential - Peregrine Survey Results).

9.1.3 Appendix A9.3 (Confidential Ecology Features) and Figures 9.7 and 9.8 are not published with the Environmental Impact Assessment (EIA) Report due to the potential risk to protected species from locational data being made publicly available. However, these will be submitted to:

- Marine Scotland;
- Falkirk Council;
- Fife Council;
- Scottish Natural Heritage (SNH); and
- Transport Scotland.

9.1.4 A detailed consideration of the potential for any likely significant effects on the conservation objectives of the following European sites, in the context of The Conservation (Natural Habitats, & c.) Regulations 1994 (as amended) (referred to as the Habitats Regulations), has been undertaken in a Habitats Regulations Appraisal (HRA) for the proposed scheme:

- Firth of Forth Special Protection Area (SPA);
- Firth of Forth Ramsar; and
- River Teith Special Area of Conservation (SAC).

9.2 Legislation, Policies and Guidance

9.2.1 As detailed above, professional judgement is the principal factor for determination of impact significance; however, the assessment is also guided by legislation, national policies and recognised guidance.

9.2.2 Appendix A4.1: Assessment of Policy Compliance provides further information on planning policies and guidance from national to local level which are relevant to terrestrial ecology.

9.2.3 As the assessments within the terrestrial ecology chapter are cognisant of relevant conventions and legislation, a summary of these is provided in Table 9.1.

Table 9.1: Relevant Legislation and Conventions

Legislation and Conventions	Summary
International	
The Habitats Directive (92/43/EEC)	The European Union Directive (92/43/EEC) on the Conservation of natural habitats and of wild fauna and flora (Habitats Directive) is the means by which the Community meets its obligations as a signatory of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). The Directive introduces a range of measures including the protection and surveillance of habitats and species. The main aim of the Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species at a favourable conservation status, introducing robust protection for those habitats and species of European importance. The habitats listed in Annex I of the Directive and the species listed in Annex II, are to be protected by means of a network of sites. Each Member State is required to prepare and propose a national list of sites for evaluation in order to form a European network of Sites of Community Importance (SCIs). Once adopted, these are designated by Member States as SACs, and along with SPAs classified under the Birds Directive, form a network of protected areas known as Natura 2000.
The Birds Directive (79/409/EEC)	The European Union Directive on the Conservation of wild birds (79/409/EEC) was adopted in 1979. The Birds Directive is a primary tool for delivering EU obligations under the Convention on

Legislation and Conventions	Summary
	Biological Diversity (CBD), the Ramsar and Bonn Conventions. The Birds and Habitats Directives require Member States to take a number of measures/actions in order to protect all bird species, their sites and their habitats, these include: measures to conserve and maintain all naturally occurring bird species across the EU through the designation of SPAs for species listed on Annex I of the Directive and migratory species.
Ramsar Convention	The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention or Wetlands Convention) was adopted in Ramsar, Iran in February 1971 and entered into force in December 1975. The Convention covers all aspects of wetland conservation and comprises three elements of activity: the designation of wetlands of international importance as Ramsar sites; the promotion of the wise use of all wetlands in the territory of each country; and international co-operation with other countries to further the wise use of wetlands and their resources.
National Legislation	
The Wildlife and Countryside Act 1981 (as amended)	The Wildlife and Countryside Act 1981 (as amended) is the principal mechanism for wildlife protection in the UK. Its aim is to implement the requirements of the Bern Convention and the Birds Directive. The statutory designation of SSSI is the main site protection measure in the UK established under the Act.
Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland)	The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) transpose the EC Habitats Directive into national law. The Regulations provide for the designation and protection of 'European sites', the protection of 'European Protected Species', and the adaptation of planning and other controls for the protection of European sites. Under the Regulations it is an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in the animals listed in Schedule 2 of the Regulations, or to pick, collect, cut, uproot, destroy, or trade the plants listed in Schedule 4. These actions can however be made lawful through the granting of licences by the appropriate authorities. Licences may be granted for a number of purposes (such as science and education, conservation, preserving public health and safety), but only after the appropriate authority is satisfied that there are no satisfactory alternatives and that such actions will have no detrimental effect on the conservation status of the species concerned.
Nature Conservation (Scotland) Act 2004	This Act places duties on public bodies in relation to the conservation of biodiversity. It also amends and strengthens existing nature conservation legislation and increases protection for SSSIs. In addition, the Act places a duty on every public body to further the conservation of biodiversity and requires Scottish Ministers to designate one or more strategies for the conservation of biodiversity as the Scottish Biodiversity Strategy. It also requires Scottish Ministers to publish a list of habitats and species considered to be of principal importance for biodiversity. The Scottish Biodiversity List (SBL) is intended to be a tool for public bodies and an important source of information and guidance for all.
European Union (Withdrawal Agreement) Act 2020	The UK government published the European Union (Withdrawal) Bill on 13 July 2017, which transfers all existing EU law into domestic 'retained EU law' and gives powers to UK Ministers to change or remove this retained law. The Withdrawal Bill received Royal Assent on 26 June 2018 and was written into law as the Withdrawal Act. In January 2020, the European Union (Withdrawal Agreement) Act 2020 was also passed in Parliament. This makes provisions for ratifying the Brexit Withdrawal Agreement which sets the terms of the UK's withdrawal from the EU. The UK left the EU on 31 January 2020. Most of the UK's wildlife and environmental legislation is based on EU legislation. The key pieces of legislation to replace these include the Environment Bill, Agriculture Bill and Fisheries Bill which are currently being considered in parliament.

National Policy

Biodiversity Action Plan

9.2.4 The proposed scheme is covered by Second Nature, A Biodiversity Action Plan (BAP) for the Falkirk Council area (Falkirk Council 2019). Second Nature is the third BAP for the Falkirk Council area and was published in March 2019.

9.2.5 The Falkirk Council area includes 24 types of habitat, and at least 45 plants and animals, which are UK priorities for conservation action (Falkirk Council 2019). Second Nature identifies 20 local priority

habitats, 102 local priority species and includes nine action plans that will benefit local wildlife. The 'Estuary' and 'Water and Wetland' action plans are particularly relevant to the proposed scheme (Falkirk Council 2019).

9.2.6 Where ecological features listed in Second Nature are located within the study area, these are detailed in Table 9.5.

9.2.7 The Fife Local BAP (LBAP) (Fife Biodiversity Partnership 2013) includes wintering waders and wildfowl, and otter as keystone species within their 'Freshwater and Wetland Ecosystem' action plan. Mobile species that are covered by Fife LBAP are also included within the Falkirk BAP and other designations assessed in this EcIA. Therefore, there has been due consideration of the Fife LBAP species. It should also be noted that the Fife LBAP covers the northern shore of the estuary which is not impacted by the refurbishment.

Scottish Biodiversity Strategy

9.2.8 The Scottish Biodiversity Strategy is comprised of two published documents:

- Scotland's Biodiversity: It's in Your Hands (Scottish Executive 2004); and
- 2020 Challenge for Scotland's Biodiversity (Scottish Government 2013).

9.2.9 The strategy aims to promote sustainable development by ensuring that biodiversity values and opportunities are integrated into national and local development and planning processes and are taken fully and efficiently into account in the decision making process (Scottish Executive 2004; Scottish Government 2013). Potential impacts on biodiversity values have been considered within this assessment and protected through proposed mitigation.

Scottish Biodiversity List (SBL)

9.2.10 The SBL is the statutory list of animals, plants and habitats considered by the Scottish Ministers to be most important for biodiversity conservation in Scotland. The publication of the SBL satisfies the requirements of The Nature Conservation (Scotland) Act 2004, which places a duty on public bodies to further the conservation of biodiversity. Details of ecological features within the study area that appear on the SBL are in Table 9.5.

9.3 Approach and Methods

9.3.1 The approach to this assessment is based on the guidance provided by:

- DMRB Volume 11, Section 3, Part 4: Ecology and Nature Conservation (Highways Agency, Scottish Government, Welsh Assembly Government and the Department of Regional Development Northern Ireland 1993);
- the Chartered Institute for Ecology and Environmental Management's (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM 2018); and
- DMRB Interim Advice Note 130/10 'Ecology and Nature Conservation: Criteria for Impact Assessment' (Highways Agency, Scottish Government, Welsh Assembly Government and the Department of Regional Development Northern Ireland 2010) (hereafter referred to as IAN 130/10).

9.3.2 In addition to the above guidance, other policy documents and published guidance taken into account in the preparation of this chapter include:

- Environmental Impact Assessment Handbook (SNH 2018a);
- Scottish Government's Planning for Natural Heritage: Planning Advice Note 60 (Scottish Government 2000); and

- Scottish Government's Planning Advice Note 1/2013: Environmental Impact Assessment (Scottish Government 2017).

Consultation

9.3.3 A summary of the consultation process is provided in Chapter 5 (Consultation and Scoping) and includes input from the following consultees:

- Scottish Environment Protection Agency (SEPA);
- SNH;
- Falkirk Council;
- Fife Council;
- British Trust for Ornithology (BTO); and
- Royal Society for the Protection of Birds (RSPB).

Study Area

9.3.4 The site survey areas vary in line with standard survey guidance for ecological features according to their sensitivity, mobility and habitat, and are described in Table 9.2.

9.3.5 National Biodiversity Network (NBN) Atlas Scotland desk-based searches were undertaken up to 10km from the proposed scheme to take into account the highly mobile nature of some species and the level at which some data are available (10km grid square). Results are presented in Appendix A9.2 (Detailed Methods and Baseline Data

Baseline Conditions

Desk-based Assessment

9.3.6 The desk-based assessment consisted of a review of existing relevant literature and data, including:

- the Environmental Statement (ES) for the Upper Forth Crossing project (hereafter referred to as 2003 ES) (Scottish Executive 2003); and
- the Kincardine Bridge Refurbishment the Environmental Review Report (2009) (hereafter referred to as 2009 ERR) (Jacobs 2009).

9.3.7 Information for the desk-based assessment was obtained from the following online resources:

- Joint Nature Conservation Committee (JNCC) website (JNCC 2018);
- NBN Atlas Scotland (NBN Atlas Partnership 2018) (only records held under an Open Government Licence, Creative Commons Zero (CC0) or Creative Commons Attribution 4.0 International (CC BY 4.0) licence were used); and
- SNH Information Service (SNH 2018b).

Site Surveys

9.3.8 Terrestrial ecology site surveys were undertaken as described in Table 9.2 and in Appendix A9.2 (Detailed Methods and Baseline Data).

9.3.9 Site surveys were undertaken between 2017 and 2019 by suitably experienced ecologists. Baseline results represent conditions at that time.

9.3.10 The survey scope was determined following the extended Phase 1 habitat survey. Site surveys were not undertaken for any further terrestrial features other than those detailed in Table 9.2 due to the limited potential for direct and indirect effects from the proposed scheme. A Scoping Report (Jacobs 2018) detailing the scope for site surveys was sent to relevant stakeholders for consultation (Chapter 5: Consultation and Scoping).

Table 9.2: Details of Surveys Undertaken to Inform the EcIA.

Survey Type	Guidance	Date Ranges	Methods
Extended Phase 1 habitat survey	JNCC 2010	June 2017 and November 2019	An extended Phase 1 habitat survey was undertaken in June 2017, and updated in November 2019, within 250m around the Kincardine Bridge to identify and map the habitats present. Specific ecological features of interest were identified as numbered Target Notes (TN). The 'extended' element of the survey identified evidence of protected or notable species, including invasive non-native animal and plant species.
Bat: ground-based roost assessment	Collins 2016	November 2017	To determine the potential impacts on roosting bats and inform future survey requirements, the Kincardine Bridge and all buildings, structures and trees within 50m of the proposed works at the southern piled viaduct were subject to initial external ground-based assessments. These assessments identified features present and classified their likelihood to support roosting bats (negligible, low, moderate, high).
Bat: activity surveys		June – August 2017	To identify presence/likely absence of roosting bats within the Kincardine Bridge three bat activity surveys were undertaken on the 22 June, 14 July and 9 August 2017. These surveys were designed to enable the recording of observations of bat species, emergences or re-entries from the bridge and flight-lines. Surveys were carried out using hand-held frequency division bat detectors (Batbox Duet) with Tascam DR-05 linear Pulse-code modulation (PCM) recorders and Anabat Walkabout and Echo Meter Touch full spectrum detectors. Acoustic files were analysed using BatSound 4.2, Analook W V4.1z or Analook Insight version 21926.
Bat: passive detectors		August – September 2017 May – June 2018	To identify bat flight-lines and their ability to use multiple aspects of the landscape, such as the bridge as a commuting route, passive monitoring was conducted at the Kincardine Bridge. Four Anabat Express bat detectors were deployed at four locations along the bridge between August – September 2017 and May – June 2018. A total of 36 nights of data were recorded in 2017 and 31 in 2018. Acoustic files were analysed using Analook W V4.1z.
Birds: wetland (Through The Tide Count surveys)	Bibby, Burgess, Hill and Mustoe 2000 BTO 2008 Rose & Scott 1997	April 2017 – April 2018	Through The Tide Count (TTTC) surveys were undertaken from late April 2017 to April 2018 inclusive. Surveys recorded the numbers, distribution and behaviour of all estuarine birds present in the Forth Estuary (the shoreline, intertidal and open water areas) up to 500m either side of the Kincardine Bridge across four survey sectors (S1, S2, N1, N2) (Figure 9.1) to identify important areas for overwintering and migratory bird assemblages. Surveys were conducted twice a month and on each survey day, two replicates of the survey area were undertaken to ensure data was collected at two different tidal states each day. During each count, birds were viewed with the assistance of binoculars and telescopes, from specific vantage points (VPs), thus enabling the entire survey area to be observed (Figure 9.1). Surveyors recorded the number, location and behaviour of all birds on both paper and electronic maps. Data were recorded using standard BTO bird species codes with the number of individuals of each species recorded in superscript and the related behaviour (flying, loafing, roosting or foraging) indicated in subscript text. In addition to bird data, weather (wind speed and direction, rainfall, cloud cover and visibility) and sources of potential or actual disturbance to birds were recorded during the counts.
Birds: goose roosts	Gilbert, Gibbons and Evans 1998	September 2017 – March 2018	The habitat surrounding Kincardine Bridge is known to provide suitable habitat for regularly occurring roosting geese. Therefore, to identify the importance of the area to geese, surveys were undertaken in winter 2017/18 between September and March (inclusive) to identify overnight goose roosts within 500m from the southern piled viaduct of the Kincardine Bridge. Surveys were undertaken every two weeks at dawn commencing one hour prior to civil dawn for two hours (when the geometric centre of the sun is 6° below the horizon in the morning). Surveys were undertaken from viewpoints VP1 to

Survey Type	Guidance	Date Ranges	Methods
			VP6 to encompass the intertidal mudflats and saltmarsh in survey sectors S1 and S2 (Figure 9.1); Sectors N1 and N2 were not surveyed as habitat is not suitable for geese. The number (and species) of geese roosting in survey sectors S1 and S2 were counted and their spatial locations marked on maps for later digital recording. Additionally, the number of geese flying over, landing in the survey sectors S1 and S2 from another site or taking off from the survey sectors S1 and S2 to another were counted and mapped during the survey period.
Birds: breeding	Bibby, Burgess, Hill and Mustoe 2000 Marchant 1983	May – July 2017 April – May 2018	Surveys targeting breeding birds were undertaken each month between May – July 2017 and April – May 2018. Surveys, undertaken in the early morning, consisted of a walkover extending 500m to either side of the Kincardine Bridge where access allowed recording location, species and activity of every individual bird observed (sight and/or sound) within or flying over the survey area using standard BTO conventions.
Great crested newt (GCN)	Oldham, Keeble, Swan and Jeffcote 2000 Amphibian and Reptile Group (ARG) UK, 2010	November 2018 and November 2019	Waterbodies within the footprint of the proposed scheme and to a 500m buffer from the southern piled viaduct of the Kincardine Bridge were identified using online aerial photography and Ordnance Survey maps. Identified ponds were ground-truthed and a Habitat Suitability Index (HSI) assessment was conducted using standard methodology in November 2018 and updated in November 2019. As HSI assessments were conducted outwith the GCN breeding season, the methods were also adapted to account for this. See Appendix A9.2 (Detailed Methods and Baseline Data) for further detail.
Otter	Chanin 2003	November 2017 – June 2018 November 2019	A survey to enable the assessment of otter presence/likely absence was conducted in November 2018 within 250m from the southern piled viaduct of the Kincardine Bridge, mainly along watercourses and waterbodies. An update survey was undertaken in November 2019. Surveyors recorded field signs indicative of otter, such as: • shelters (above ground couches and below ground holts); • spraints, prints, slides or other well-used access points to watercourses; • feeding remains; and • sightings (including Wildlife Vehicle Incidents (WVI)). An infra-red camera trap was deployed under licence from SNH (licence number: 117659) to monitor an identified otter shelter from November 2017 until June 2018.
Peregrine	Hardey, Crick, Wernham, Riley, Etheridge and Thompson 2013	April – June 2018	Incidental sightings of peregrine indicated that individuals were present in the survey area. Therefore, surveys to establish whether peregrine were nesting in the survey area and fledgling success were undertaken at the Kincardine Bridge in late-April, early-June and mid-June 2018. Surveys were undertaken by two ecologists, one being an experienced raptor surveyor, using binoculars and telescope, between 07:00 and 11:00. Surveyors recorded each observation of a peregrine including the sex, time observed, the average height of flight, any disturbance and any other supporting notes on the behaviour of the bird(s). Detailed survey methods can be found in Appendix A9.3 (Confidential Ecology Features).

Impact Assessment

9.3.11 The assessment has been undertaken through interpretation of baseline data, review of relevant literature and websites, application of relevant legislation, consultation and use of professional judgement. The assessment has been based on the information provided in Appendix A3.1 (Construction Information). The principles and approach of the CIEEM guidance (CIEEM 2018) have been acknowledged and standard impact assessment terms have been used, where appropriate, to provide consistency with the other assessments in this EIA Report.

9.3.12 In making this assessment, the ecological feature is defined as the habitat, species or ecosystem within the receiving environment that may be affected by the change. The impact represents the actions resulting in effects on an ecological feature.

9.3.13 An assessment of the significance of effect is carried out by first determining the baseline conditions and value/sensitivity (importance) of the feature, followed by characterising the impact on the feature; the significance of effect being a combination of these variables.

Feature Importance

9.3.14 Whilst biodiversity should be protected in its entirety wherever possible, '*it is not necessary to carry out detailed assessment of features that are sufficiently widespread, unthreatened and resilient to project impacts*' (CIEEM 2018). Only features considered important and potentially affected by the proposed scheme are subject to impact assessment. Therefore, features that do not meet the criteria for at least local importance are not considered in detail in this assessment.

9.3.15 The general approach to defining the importance of ecological features followed CIEEM guidance (2018). The approach is also in line with advice given in IAN 130/10 (Highways Agency et al. 2010). Ecosystems, habitats and species were assigned levels of importance for nature conservation based on baseline conditions and the criteria set out in Table 9.3.

9.3.16 Factors taken into account in determining the importance of an ecological feature included its:

- rarity and uniqueness;
- ability to resist or recover from environmental change;
- function/role within an ecosystem; and
- level of legal protection or designation.

Table 9.3: Importance Criteria for Ecological Features

Feature Importance	Criteria
International	**Ecosystems and Habitats** Ecosystems or habitats essential for the maintenance of: • internationally designated areas or undesignated areas that meet the criteria for designation; and/or • viable populations of species of international conservation concern. **Species** Species whose presence contributes to: • the maintenance of qualifying habitats, communities and assemblages that occur within internationally designated sites or within undesignated areas that meet the criteria for such designation.
National	**Ecosystems and Habitats** Ecosystems or habitats essential for the maintenance of: • qualifying communities and assemblages that occur within nationally designated sites or within undesignated areas that meet the criteria for such designation; and/or • viable populations of species of national conservation concern.

Feature Importance	Criteria
	Species Species whose presence contributes to: • the maintenance of qualifying habitats, communities and assemblages that occur within nationally designated sites or within undesignated areas that meet the criteria for such designation; or • the maintenance and restoration of biodiversity and ecosystems at a national level, as defined in the Scottish Biodiversity Strategy (SBS) (Scottish Government 2013; Scottish Executive 2004).
Regional	**Ecosystems and Habitats** Ecosystems or habitats essential for the maintenance of: • communities and assemblages that occur within regionally important sites or localities listed as being of conservation importance in the Falkirk BAP (Falkirk Council 2019) or within undesignated areas that meet the criteria for such designation; • key habitat systems listed in the Falkirk BAP; and/or • viable populations of species of regional conservation concern. **Species** Species whose presence contributes to: • the maintenance and restoration of biodiversity and ecosystems at a regional level, as described in the Falkirk BAP.
Authority Area	**Ecosystems and Habitats** Ecosystems or habitats essential for the maintenance of: • populations of species of conservation concern within the authority area. **Species** Species whose presence contributes to: • the maintenance and restoration of biodiversity and ecosystems at authority area level, as defined in the Falkirk BAP.
Local	**Ecosystems and Habitats** Ecosystems or habitats essential for the maintenance of: • populations of species of conservation concern within the local area of the Kincardine Bridge. **Species** Species whose presence contributes to: • the maintenance and restoration of biodiversity and ecosystems at a local level.

Characterisation of Impact

9.3.17 For the purposes of this assessment, the characterisation of impacts in Table 9.4 are taken to summarise the overall characterisation of positive or negative impacts in accordance with CIEEM guidelines (2018), considering:

- impact extent/scale (e.g. entire habitat loss, partial habitat loss or indication over specific area affected);
- direct or indirect impact (e.g. direct mortality of individuals from vehicle collisions, or indirect mortality of individuals from reduced prey resources due to pollution of watercourses);
- reversibility of impact (reversible or irreversible);
- frequency and timing of impact (single event, recurring or constant, occurring during a critical life-stage);
- duration of impact (short-term, medium-term, long-term or permanent); and
- likelihood of occurrence (certain/near certain, probable, unlikely or extremely unlikely).

9.3.18 With the use of professional judgement and the criteria outlined in Table 9.4, impacts on terrestrial ecological features were characterised as major, moderate, minor or negligible.

Table 9.4: Impact Characterisation for Ecological Features

Characterisation of Impact	Criteria
Major	An impact likely to permanently affect the integrity of a feature in terms of the coherence of its ecological structure and function to the ecosystem; and affect the conservation status and/or objectives of a feature. The feature is degraded to the extent that populations and/or habitats are destroyed, or sensitive life stages are affected. Features experience continuous, irreversible, long-term change. The feature has low capacity to adapt to change. Recovery, if it occurs, would be expected to be long-term after the source of impact has been removed. Impacts not limited to areas proximal and adjacent to the development, with impacts possibly detectable beyond the study area.
Moderate	The impact is not likely to permanently affect the integrity of a feature but may be substantial in terms of its effect on ecological structure and function and may affect the conservation status and/or objectives of a feature. The feature is degraded to the extent that populations and/or habitats experience a reduction in number or range in the medium to short-term. Features experience regular intermittent change which may affect sensitive life stages. The feature has medium capacity to adapt to change. Recovery would be expected to occur in the medium-term after the source of impact has been removed. Impacts generally limited to areas proximal and/or adjacent to the development.
Minor	The impact would not permanently affect the integrity of the feature, but features may experience some limited degradation. Disturbance is detectable but experienced within the range of natural variability in the medium to short-term. Features experience intermittent irregular change and sensitive life stages are not affected. The feature has high capacity to adapt to change. Recovery would be expected to occur in the short-term after the source of impact has been removed. Impacts limited to area proximal to development.
Negligible	The impact would not permanently affect the integrity of the feature and there would be little or no degradation. The change to baseline conditions is not detectable. Disturbance is experienced within the range of natural variability in the short-term. Features experience occasional change and sensitive life stages are not affected. The feature has very high capacity to adapt to change. Recovery would be expected relatively quickly after the source of impact has been removed. Impacts limited to area proximal to development.

Significance of Effects

9.3.19 The level of significance of a potential effect is determined as a function of the importance assigned to the ecological feature and the characterisation of impact. Professional judgement is the principal factor in determining which effects would be significant, however it is generally considered that where impacts on internationally, nationally or regionally important ecological features are characterised as 'moderate' or 'major', they are considered to result in potentially significant effects under the terms of The Roads (Scotland) Act 1984 (Environmental Impact Assessment) Regulations 2017 (hereafter referred to as the Roads EIA Regulations) and mitigation would be developed to reduce significance of effects where feasible.

9.3.20 Impacts on internationally important features characterised as 'minor', and 'major' impacts on features of authority area importance, can also have potentially significant effects. There may be an additional number of impacts on a feature that, whilst not of a character to result in significant effects in themselves, may cumulatively result in a significant effect on that feature.

9.3.21 Significant effects are those that impact on structure and function of defined sites, habitats or ecosystems and the conservation status of important habitats and species (CIEEM 2018).

Mitigation

9.3.22 Under section 20C of Roads EIA Regulations the EIA Report should provide *'a description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements.'*

9.3.23 Following the baseline assessment, if a given impact is identified as having significant effects, consideration is given to the identification and application of mitigation. Mitigation will follow a hierarchical approach, seeking to avoid, reduce, and if a residual effect remains, compensate significant adverse effects.

9.3.24 Mitigation of an impact may be achieved by timing works to avoid sensitive periods for species, for example breeding seasons. Where avoidance is not possible, adverse impacts will be reduced by adhering to good practice management measures and/or the application of additional mitigative measures specific to an impact. Mitigation measures are detailed within Section 9.6 (Mitigation).

Residual Effects

9.3.25 Having taken mitigation into account, the residual effects provide a description of any remaining effects that are still significant. Residual effects on ecological features are detailed within Section 9.7 (Residual Effects).

9.3.26 Where relevant to further understanding and/or validation of a given assessment, consideration of potential monitoring of a feature has also been identified.

Limitations to Assessment

9.3.27 Survey data to inform the baseline are valid for 18 months and are sufficient for the purpose of this assessment; no limitations to assessment exist. Surveys will need to be undertaken to update the baseline prior to construction as described in Section 9.6 (Mitigation).

9.4 Baseline Conditions

9.4.1 This section summarises the existing ecological conditions within the study area that have been determined through desk-based assessment, consultation and site surveys. The baseline information is shown in Table 9.5, Appendix A9.2 (Detailed Methods and Baseline Data) and Appendix A9.3 (Confidential Ecology Features), along with supporting figures (Figures 8.1 and 9.2 to 9.8).

Designated Sites

9.4.2 The proposed scheme is located within the following overlapping statutory designated sites:

- Firth of Forth SPA - designated for the protection of an internationally important population of waders and wildfowl which visit the area during winter, and for Sandwich tern migration (SNH 2018c).
- Firth of Forth Ramsar – designated for protection of waterfowl assemblages and certain bird species populations of international importance (SNH 2018d).
- Firth of Forth Site of Special Scientific Interest (SSSI) - designated for a variety of features including breeding shelduck, eider and ringed plover (which breed at Skinflats, located downstream of the proposed scheme); marine, coastal and terrestrial habitats (including saltmarsh, mudflats, and grassland); vascular plants; invertebrates, and geological and geomorphological features (SNH 2018e).

9.4.3 The River Teith SAC (SNH 2018f) is located more than 20km upstream of the proposed scheme. It is designated for supporting migratory fish which pass through the Forth Estuary. Potential impacts on the

qualifying features of this site have been assessed in Chapter 8 (Marine Ecology) and in an HRA for the proposed scheme and are not discussed further in this chapter.

9.4.4 The RSPB Skinflats Nature Reserve is located to the south of the proposed scheme (as shown on Figure 8.1 of Chapter 8: Marine Ecology). Almost all of the reserve lies within the Firth of Forth SPA, Ramsar and SSSI and is primarily intertidal mud and a small area of saltmarsh. Key birds include migrant and wintering wildfowl, pink-footed geese and waders (RSPB 2018a). As the reserve overlaps with the Firth of Forth SPA, Ramsar and SSSI, impacts on the reserve will be assessed as part of these sites and it is not considered further in this assessment.

9.4.5 Also on the southern side of the Forth Estuary, on the upstream side of the proposed scheme, lies the Pow Burn and Estuary Wildlife Site, designated for saltmarsh habitat and associated flora and fauna (Falkirk Council 2016) (Figure 8.1). Part of the land made available for temporary works and construction lies within the Pow Burn and Estuary Wildlife Site. Torry Bay Local Nature Reserve (LNR) occurs on the northern bank of the Forth Estuary, approximately 3.5km downstream of the Kincardine Bridge and encompasses a large area of intertidal mudflat habitat. As both of these sites overlap with the Firth of Forth SPA, Ramsar and SSSI, impacts on these sites will be assessed as part of the Firth of Forth SPA, Ramsar and SSSI and are not considered further in this assessment.

Habitats

9.4.6 The survey area contains a variety of habitats, both terrestrial and marine, which are shown on Figure 9.2. Associated target notes collected during the Phase 1 habitat survey are presented in Appendix A9.2 (Detailed Methods and Baseline Data). No terrestrial habitats recorded within the survey area met the criteria for at least local importance (Table 9.2) and were not considered further as stated in paragraph 9.3.14. Intertidal habitats, particularly important saltmarsh habitats are discussed in Chapter 8 (Marine Ecology).

Species

9.4.7 Protected species known to be, or likely to be, present within the study area are detailed in Table 9.5. A confidential appendix (Appendix 9.3: Confidential Ecology Features) has been produced for otter and Schedule 1 bird records as their precise locations need to be kept confidential to protect these species.

9.4.8 In addition to the species in Table 9.5, incidental records of brown hare were recorded within the footprint of the proposed scheme during site surveys for other species. Brown hare is widespread throughout Scotland, listed on the SBL and a priority species in Second Nature, Falkirk's BAP. Brown hare is a game species and is only protected in the closed season; therefore, this species is not considered further in this assessment. However, mitigation proposed for other species, for example covering excavations at night and installing temporary mammal-resistant fencing during construction, would be likely to reduce potential impacts on brown hare.

Plants of Conservation Interest

9.4.9 Bluebell, a Schedule 8 plant species protected from selling, offering for sale, possessing or transporting for the purposes of sale under the Wildlife and Countryside Act 1981 (as amended), was recorded over 9km north-west of the proposed scheme (NBN Atlas Partnership 2018). However, no protected, rare or scarce plants, including bluebell, were recorded during the site surveys.

Invasive Non-Native Species (INNS)

9.4.10 Invasive non-native species (INNS) present a threat to biodiversity (HM Government 2018). Grey squirrel was recorded within 10km of the proposed scheme during the desk-study, with the closest record within the grounds of Powfoulis Manor Hotel 1.3km south-west of the proposed scheme. Ten records of the New Zealand flatworm, the closest of which was across the Firth of Forth to the east of the town of

Kincardine, and one record of rhododendron over 9km from the proposed scheme, were also recorded during the desk-study (NBN Atlas Partnership 2018).

Evaluation Summary

9.4.11 The evaluations presented in Table 9.5 consider baseline conditions and utilise the criteria described in Table 9.2 to develop an understanding of the implications for features that may be affected by the proposed scheme.

Table 9.5: Summary of Baseline Conditions Within the Study Area for the Proposed Scheme

Ecological Feature	Legal/BAP/SBL Status	Baseline	Justification	Importance
Designated Sites				
Firth of Forth SPA, UK9004411 (Figure 8.1)	Natura 2000 site under Conservation (Natural habitats &c.) Regulations 1994 (as amended in Scotland). Qualifies under Article 4.1 and 4.2 of EU Birds Directive. Nine qualifying species recorded during surveys are listed as priority species in Second Nature, Falkirk's BAP.	The SPA is designated for its assemblage of non-breeding estuarine birds (SNH 2018c): • bar-tailed godwit • common scoter • cormorant • curlew • dunlin • eider • golden plover • goldeneye • great crested grebe • grey plover • knot • lapwing • long-tailed duck • mallard • oystercatcher • pink-footed goose • red-breasted merganser • redshank • red-throated diver • ringed plover • Sandwich tern* • scaup • shelduck • Slavonian grebe • turnstone • velvet scoter • wigeon • waterfowl assemblage	A 6,317.93ha site that regularly supports wintering populations of Annex 1 species; post-estuarine (passage) population of Annex 1 species, Sandwich tern; wintering populations of migratory species and wintering wildfowl assemblages (SNH 2018c). The study area supports species which are qualifying interests of the Firth of Forth SPA, including regularly occurring roosting pink-footed geese to the south of the southern piled viaduct. It is estimated that 90% of the world's population of pink-footed geese spend winter on wetland and farmland habitats in the UK (Scottish Wildlife Trust 2018). The peak number of pink-footed geese recorded roosting within the survey area equates to 11.8% of the SPA population (SNH 2018c).	International

Ecological Feature	Legal/BAP/SBL Status	Baseline	Justification	Importance
		**indicates passage only* A total of 15 SPA qualifying species were recorded during the TTTC surveys over winter and Sandwich tern were recorded between July and September 2017. Pink-footed geese roosted overnight within the survey area, with a peak of 1,285 roosting birds recorded on 20 October 2017. All observations, with the exception of four observations (a total of 16 birds), were recorded roosting in Sector S2, to the south of Kincardine Bridge.		
Firth of Forth Ramsar, UK13017 (Figure 8.1)	Designated under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) 1971. Four qualifying species recorded during surveys are listed as priority species in Second Nature, Falkirk's BAP.	The Ramsar is designated for its assemblage of non-breeding estuarine birds (SNH 2018d): • bar-tailed godwit • goldeneye • knot • pink-footed goose • redshank • Sandwich tern* • shelduck • Slavonian grebe • turnstone • waterfowl assemblage **indicates passage only* A total of six Ramsar qualifying species were recorded during the TTTC surveys over winter and Sandwich tern were recorded between July and September 2017. Pink-footed geese roosted overnight within the survey area, with a peak of 1,285 roosting birds recorded on 20 October 2017. All observations, with the exception of four observations (a total of 16 birds), were recorded roosting in Sector S2, to the south of the Kincardine Bridge.	A 6,313.68ha site comprising a complex of estuaries, mudflats, rocky shorelines, beaches and saltmarshes. The site provides habitat for large numbers of wintering waders and wildfowl, many in nationally and internationally important numbers (SNH 2018d). The study area supports species which are qualifying interests of the Firth of Forth Ramsar, including regularly occurring roosting pink-footed geese to the south of the southern piled viaduct. It is estimated that 90% of the world's population of pink-footed geese spend winter on wetland and farmland habitats in the UK (Scottish Wildlife Trust 2018).	International
Firth of Forth SSSI, 8163 (Figure 8.1)	Designated under the Nature Conservation (Scotland) Act 2004. Nine qualifying species recorded during surveys are listed as priority species in Second Nature, Falkirk's BAP.	In addition to all non-breeding presence of bird species listed for the Firth of Forth SPA, the SSSI is designated for its breeding presence of: • eider • ringed plover • shelduck	A 7,423.19ha site containing extensive invertebrate-rich intertidal mudflats which provide feeding grounds for nationally and internationally important numbers of wintering and migratory birds and three breeding species. In addition, the presence of saltmarshes, which support scarce plants, provide feeding and roosting grounds for birds, and are also a natural coastal defence (SNH 2018e).	National

Ecological Feature	Legal/BAP/SBL Status	Baseline	Justification	Importance
		The SSSI is also designated for saltmarsh and mudflat habitats. These features are assessed within Chapter 8 (Marine Ecology). Other qualifying features of the SSSI, for example geological and geomorphological features, vascular plants and invertebrates are located elsewhere in the SSSI and will not be impacted by the proposed scheme and therefore will not be discussed further in this assessment. A total of 15 qualifying species were recorded during the TTTC surveys over winter. Sandwich tern were recorded between July and September 2017, and shelduck were recorded breeding within the survey area. Pink-footed geese roosted overnight within the survey area, with a peak of 1,285 roosting birds recorded on 20 October 2017. All observations, with the exception of four observations (a total of 16 birds), were recorded roosting in Sector S2, to the south of the Kincardine Bridge.	The study area supports species which are qualifying interests of the Firth of Forth SSSI, which included large numbers of shelduck during the breeding season and roosting pink-footed geese to the south of the southern piled viaduct. It is estimated that 90% of the world's population of pink-footed geese spend winter on wetland and farmland habitats in the UK (Scottish Wildlife Trust 2018).	
Species				
Peregrine (Figure 9.8)	Schedule 1 of Wildlife Countryside Act 1981 (as amended). Listed on the SBL.	Present within the study area. Refer to Appendix A9.3 (Confidential Ecology Features) for baseline data for peregrine.	Estimates from the 2014 Peregrine Survey undertaken by the BTO indicate that the number of breeding pairs in Scotland are lower than previously recorded (BTO 2014). Peregrines are faring better in urban and other lowland situations than in the uplands due to an abundant food supply (primarily feral pigeons) and a lack of persecution. Peregrines can now be more often found breeding on man-made structures in areas where natural nest sites are few and far between (BTO 2014).	National
Bats (Figure 9.3)	All UK bat species are EPS under the Conservation (Natural habitats &c.) Regulations 1994 (as amended in Scotland). Ten species of bat are known to occur in Scotland and all, with the exception of Leisler's bat, are listed on the SBL. Brown long-eared and soprano pipistrelle bat are priority species in Second Nature, Falkirk's BAP.	The Kincardine Bridge was assessed as having low bat roost potential. No bats were observed emerging from or re-entering the bridge during activity surveys. Foraging and commuting behaviour alongside and underneath the Kincardine Bridge was observed for soprano pipistrelle, common pipistrelle and *Myotis* sp. bats. Passive bat detectors recorded common and soprano pipistrelle bats, brown long-eared and *Myotis* sp.	Common and soprano pipistrelles are widely distributed throughout Scotland except in upland areas, where they are confined to river valleys (JNCC 2013b and 2013c). Brown long-eared bats are widespread in Scotland, where they occur in lowland areas and river valleys (JNCC 2013d). Daubenton's bat has been recorded throughout Scotland but may be less common in the north and west (JNCC 2013e). The survey area provides good foraging and commuting habitat, with potential for roosting sites.	Regional

Ecological Feature	Legal/BAP/SBL Status	Baseline	Justification	Importance
Wetland birds (not including qualifying species) (Figure 9.4 and 9.5)	Wildlife and Countryside Act 1981 (as amended). Nature Conservation (Scotland) Act 2004. Ten species recorded during surveys are listed as priority species in Second Nature, Falkirk's BAP.	A total of 20 non-qualifying species of wetland birds were recorded during the TTTC surveys between April 2017 and April 2018. Fifteen Firth of Forth SPA, Ramsar and SSSI qualifying species were recorded within the survey area outside of the winter period when they utilise the site. Kingfisher, a Schedule 1 species, was recorded during the TTTC surveys.	The study area supports an additional 20 species which are not qualifying interests of the Firth of Forth SPA, Ramsar, and SSSI throughout the year, as well as qualifying interests present outside of the period for which the designation protects them.	Regional
Breeding birds (Figure 9.6)	Wildlife and Countryside Act 1981 (as amended). Nature Conservation (Scotland) Act 2004. Sixteen species recorded as breeding during surveys are listed as priority species in Second Nature, Falkirk's BAP.	A total of 68 species were recorded during the breeding bird surveys, of which 40 showed breeding evidence within the survey area. Of these, ten are red-listed species and 25 are amber-listed species on the Birds of Conservation Concern Red List (Eaton, Aebisher, Brown, Hearn, Loch, Musgrove, Noble, Stroud and Gregory 2015). Two Schedule 1 species were recorded, namely peregrine and whimbrel. Shelduck, a qualifying feature of the Firth of Forth SSSI, was recorded breeding in the survey area.	Suitable habitat for breeding birds is present within the survey area, including for shelduck, a qualifying feature of the Firth of Forth SSSI for its breeding presence. Shelduck was recorded with a peak count of 680 individuals in July 2017. This represents approximately 2% of the breeding population within the UK (15,000 pairs, RSPB 2018b). Notably, however, the Firth of Forth and surrounding habitats outwith the survey area provide extensive breeding habitat for a number of species, including qualifying interests of the SPA, Ramsar and SSSI. The majority of birds recorded during the breeding season are common species, however the conservation statuses of birds within the UK are under threat, with more species being placed on the Red List than ever before (Eaton, Aebisher, Brown, Hearn, Loch, Musgrove, Noble, Stroud and Gregory 2015).	Regional
Great crested newt	EPS under the Conservation (Natural habitats &c) Regulations 1994 (as amended in Scotland). Listed on the SBL. Priority species in Second Nature, Falkirk's BAP.	The HSI assessment identified the existing SuDS (Sustainable Drainage System) pond within the study area as having poor suitability with poor connectivity to the wider environment. In addition, there was negligible hibernation potential within the study area and a lack of suitable habitat within and surrounding the proposed scheme.	GCN occur in three main areas in Scotland: Borders, Central Belt and Moray Firth (Wilkinson et al. 2014). They are often found on the fringes of urban areas, including previously built-up brownfield sites, where they are very vulnerable to impacts from new development. They breed in small to medium sized freshwater ponds, but also live on land in lowland grassland, scrub, hedgerows or woodland, normally within 500m of breeding ponds. They hibernate over winter (October-February) under deadwood, among tree roots, rocks and piles of rubble, or in mammal burrows. When active on land at other times of the year they continue to use similar refuges or dense vegetation for resting up during the day (SNH 2017).	Regional

Ecological Feature	Legal/BAP/SBL Status	Baseline	Justification	Importance
Otter (Figure 9.7)	EPS under the Conservation (Natural habitats &c) Regulations 1994 (as amended in Scotland). Listed on the SBL. Priority species in Second Nature, Falkirk's BAP.	Present within the study area. Refer to Appendix A9.3 (Confidential Ecology Features) for baseline data for otter.	Scotland is a European stronghold for otter. The species is assessed as being close to carrying capacity (JNCC 2013a), i.e. the maximum population size of the species that the environment can sustain indefinitely taking account of food, habitat availability, water and other requirements.	Regional
Barn owl	Schedule 1 of Wildlife Countryside Act 1981 (as amended). Listed on the SBL. Priority species in Second Nature, Falkirk's BAP.	A barn owl was recorded during a goose roost survey in scrub habitat along the southern approach to Kincardine Bridge. NBN Atlas Scotland (NBN Atlas Partnership 2018) also provided a record of barn owl within 10km southwest of the Kincardine Bridge in 2009. However, no suitable habitat for nesting barn owl is present within the vicinity of the proposed scheme.	Favoured habitats for barn owl contain areas of rough grassland and woodland edge, including the early successional stages of commercial plantation forest. The last national survey, carried out between 1994 and 1997, put the population at c.4,000 breeding pairs. Though previously Amber listed through its loss of UK range, the species was moved to the UK Green list in 2015 (BTO 2020).	Regional
Pine marten	Wildlife and Countryside Act 1981 (as amended). Listed on the SBL. Priority species in Second Nature, Falkirk's BAP.	NBN Atlas Scotland (NBN Atlas Partnership 2018) provided records of pine marten from 2012-2013 in suitable woodland habitat in Devilla Forest, which is east of the town of Kincardine across the Firth of Forth. No woodland habitat with the potential to support pine marten is present in the vicinity of the proposed scheme.	Pine martens are now established across much of Scotland north of the central belt, with outlying populations in parts of the Scottish Borders and Dumfries and Galloway. Scotland's population is estimated at 3,700 adult pine martens and the species was given full legal protection in 1988 (SNH 2020).	Regional

9.5 Potential Impacts

Introduction

9.5.1 Potential impacts on ecological features for the proposed scheme are described below and are set out in Table 9.7. As stated in paragraph 9.3.14, only important ecological features are subject to impact assessment and features that did not meet the criteria for at least local importance are therefore not considered further.

9.5.2 The following protected species were also recorded within the study area, but based on baseline data are not anticipated to be affected by construction or operation impacts from the proposed scheme and as such are not considered further in this chapter:

- great crested newt;
- barn owl: and
- pine marten.

9.5.3 Where an impact is initiated in construction, but also occurs throughout operation (e.g. permanent habitat removal), it is discussed only within operational impacts.

9.5.4 Potential impacts detailed in this assessment are based on the current baseline as provided in Section 9.4 (Baseline Conditions). Due to the mobile nature of animals and changes in distribution of plant species, surveys to update the baseline will be undertaken prior to construction as detailed in Section 9.6 (Mitigation).

9.5.5 Potential construction impacts include:

- injury or mortality of protected species due to vegetation removal, vehicle movements or becoming trapped in uncovered holes and pipes;
- temporary habitat loss in working areas;
- temporary habitat fragmentation due to disturbance;
- disturbance to protected species from noise, vibration, lighting and movement of vehicles and increased human activity;
- sediment release and runoff from construction works; and
- temporary hydrological changes to habitats.

9.5.6 Potential operation impacts include:

- permanent loss of protected species habitat under footprint of the proposed scheme.

Embedded Mitigation

9.5.7 Throughout the design process, a number of embedded mitigation features have been included in the proposed scheme design. These embedded mitigation features are considered within the context of the impact assessment as providing mitigation to avoid or reduce environmental impacts. These measures are detailed in Chapter 3 (The Proposed Scheme).

9.5.8 Embedded mitigation with the potential to reduce impacts on terrestrial ecology includes the design of the piled viaduct. The proposed piled viaduct replacement structure will comprise spans of a similar size and appearance to the existing 15m spans of the adjacent Kincardine Bridge structure. This will result in minimal potential for local alterations to flow patterns, increased erosion and sedimentation, and flood storage losses with the Firth of Forth SPA, Ramsar and SSSI.

Assessment of Effects

9.5.9 The assessment is feature led and considers each of the ecological features listed in Table 9.5 before the application of any mitigation.

Construction

Firth of Forth SPA, Ramsar and SSSI

9.5.10 The land made available for temporary works and construction shown on Figure 9.1 to 9.8 covers a footprint up to approximately 3.87ha. Within this area, the proposed scheme requires temporary loss of 3.24ha of habitat within the Firth of Forth SPA, Ramsar and SSSI, of which 2.99ha comprises saltmarsh habitat. Construction of the proposed scheme will result in a temporary loss of this habitat available to the qualifying bird species of the SPA, Ramsar and SSSI. This may lead to localised fragmentation and displacement of individual birds. This habitat is of international (SPA and Ramsar) and national (SSSI) importance and would be lost for the duration of construction, which is anticipated to be between 18 to 24 months. The area temporarily lost during construction comprises a total of 0.05% of the area of the SPA/Ramsar sites as a whole (less for the SSSI which is larger in area) and there would be remaining, unaffected habitat available for qualifying species of the sites. However, due to compression of the sediments under the working platform, the ground level will be lowered, leading to the natural geomorphic processes being compromised. This may affect the natural recovery of the saltmarsh in this location (Chapter 8: Marine Ecology). This would therefore be a major impact resulting in a significant effect.

9.5.11 Noise, vibration and light spill associated with construction related activities have the potential to disturb qualifying species when they are present; the SPA, Ramsar and SSSI are designated for wintering birds, Sandwich tern during passage (late July/August to September) and breeding eider, ringed plover and shelduck (SNH 2018c; 2018d; 2018e). This could lead to displacement of birds from areas used for foraging, loafing and overnight roosting, and subsequently additional energy expenditure and loss of conditioning. This would be a moderate impact resulting in a significant effect.

9.5.12 There is the potential for runoff and release of sediment from accidental spillage during construction leading to pollution of the SPA, Ramsar and SSSI habitat used by the qualifying species of the sites. This could result in deterioration of the habitat and thus a decline in foraging habitat quality, subsequently leading to direct mortality of individuals. Depending on the magnitude of the pollution event, there could be irreversible long-term effects; this would be a moderate impact resulting in a significant effect.

9.5.13 The presence of the temporary raised working platform could result in localised changes in hydrology which could alter erosion and deposition in the immediate area, potentially altering the habitat used by qualifying bird species. The area affected would be minimal in relation to the size of the Firth of Forth SPA, Ramsar and SSSI resulting in a minor impact, but significant effect due to the importance of the features.

Peregrine

9.5.14 Peregrine nest and rear their chicks in the vicinity of Kincardine Bridge; refer to Appendix A9.3 (Confidential Ecology Features) for baseline data for peregrine. The nest location will not be destroyed as part of the refurbishment works. Noise, vibration and light spill associated with construction related activities could lead to disturbance of this species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), which could influence breeding success, feeding and behaviour. Peregrine are more susceptible to disturbance early in the breeding season (breeding season is typically March to July inclusive) and could abandon a breeding attempt depending on the level of disturbance. However, peregrine exhibit tolerance (Ruddock and Whitfield, 2007) and it was observed during the surveys that the peregrine present on site are habituated to traffic noise and road maintenance works; therefore, it is

considered that this would be a moderate impact, with significant effect on a feature of national importance.

Bats

9.5.15 The existing piled viaduct has low roost potential and no evidence of roosting bats was observed within the structure. However, bats were recorded foraging and commuting in the vicinity of the proposed scheme. Noise, vibration and light spill associated with construction related activities has the potential to result in disturbance of this EPS leading to avoidance of existing commuting routes and foraging areas during the active season, potentially resulting in use of less suitable alternatives. This would be a minor impact, on a feature of regional importance, which does not result in a significant effect.

9.5.16 Although impacts on bats are not significant, measures to adhere to species protection legislation would be applied.

Wetland Birds

9.5.17 Wetland birds, for the purpose of this assessment, refers primarily to species which are not qualifying interests of the Firth of Forth SPA, Ramsar or SSSI; qualifying interests are assessed separately under the Firth of Forth SPA, Ramsar and SSSI (paragraphs 9.5.10 to 9.5.13). In addition, this term also includes any qualifying interest which is present outwith the sensitive period for which the site(s) are designated. The SPA, Ramsar and SSSI are designated for wintering birds, Sandwich tern during passage (late July/August to September) and breeding eider, ringed plover and shelduck (SNH 2018c; 2018d; 2018e), therefore these species present at other times of the year would be included as 'wetland birds'. Potential impacts on wetland birds are the same as those detailed in paragraphs 9.5.10 to 9.5.13 for the SPA, Ramsar and SSSI. However, due to the regional evaluation of this feature, changes in hydrology would be a minor impact which does not result in a significant effect.

Breeding Birds

9.5.18 Construction related activities during the breeding bird season (01 March to 31 August), including vehicle movement which could affect ground nesting species, and vegetation clearance, particularly of the scrub and hedgerow on either side of the approach road to the Kincardine Bridge, could result in direct mortality. Mortality of individuals would be a permanent and negative effect. However, this effect is unlikely to occur in sufficient numbers to affect the wider population(s) and would be a minor impact on a feature of regional importance, which does not result in a significant effect.

9.5.19 Noise, vibration and light spill associated with construction related activities during the breeding bird season (01 March to 31 August) has the potential to result in disturbance. This could lead to avoidance of habitats and displacement of population(s). This would be a minor impact, which does not result in a significant effect.

9.5.20 Temporary loss of habitat to accommodate construction could potentially result in fragmentation and displacement of species that use this habitat for breeding. However, the area of habitat temporarily lost would be negligible given the amount of remaining habitat available. It is anticipated that this would therefore be a negligible impact, which does not result in a significant effect.

9.5.21 Although impacts on breeding birds are not significant, measures to adhere to species protection legislation would be applied.

Otter

9.5.22 Otter use the site for shelter, breeding, commuting and foraging. Construction related activities, including vehicle movement, construction of the temporary bridge and replacement piled viaduct and creation of excavations could potentially result in direct mortality of otters moving across site from

collisions, or entrapment in uncovered holes, pipes or machinery. Mortality of individuals would be a permanent and negative effect. However, this effect is unlikely to occur in sufficient numbers to affect the wider population and would be a minor impact on a feature of regional importance, which does not result in a significant effect.

9.5.23 Noise, vibration and light spill associated with construction related activities has the potential to result in disturbance of this EPS, leading to avoidance of key habitats used for foraging and commuting, and fragmentation of commuting routes through temporary loss of habitat. This is unlikely to occur at a level that will cause declines in population as the species is widespread in the area. This would be a minor impact, which does not result in a significant effect.

9.5.24 There is the potential for runoff and release of sediment from accidental spillage during construction leading to pollution of surrounding watercourses, resulting in reduced prey availability and a decline in foraging habitat quality for otter. This would be a minor impact, which does not result in a significant effect.

9.5.25 Although impacts on otter are not significant, measures to adhere to species protection legislation would be applied.

Operation

9.5.26 As the replacement piled viaduct structure will become part of the existing operational Kincardine Bridge, the effects and potential impacts on terrestrial ecological features during the operation phase are not envisaged to vary detectably from the baseline conditions. The exception is the loss of a known otter breeding holt, as discussed below.

Otter

9.5.27 As a result of the replacement structure, a known otter holt which is used as part of a breeding site will be permanently lost. This would be a major impact with significant effect on a feature of regional importance.

9.6 Mitigation

Introduction

9.6.1 Mitigation will follow a hierarchical approach in the following order (CIEEM 2018; SNH 2018a):

- avoid adverse impacts in the first instance;
- where avoidance is not possible, reduce the adverse impacts through appropriate design and mitigation; and
- where significant adverse residual effects remain, measures to offset the adverse impacts at a site-specific level may be required (compensation).

9.6.2 The proposed mitigation is designed to enhance and produce a net gain for biodiversity where practicable in line with policy and guidelines (CIEEM 2018).

9.6.3 This section includes mitigation that aims to avoid or negate effects on ecological features in accordance with best practice guidance and UK, Scottish and local government environmental impact, planning and sustainability policies. Where these effects can be fully mitigated, they would not be considered significant under the terms of the Roads EIA Regulations.

9.6.4 Potential significant ecological effects as shown in Table 9.7 are expected to be mitigated through a combination of best practice/typical mitigation methods, and mitigation specifically relating to Terrestrial Ecology ('**TE**' Mitigation Item references) targeted to specific impacts and locations.

Mitigation measures from Chapter 8 (Marine Ecology) ('**ME**' Mitigation Item references) and Chapter 12 (Noise and Vibration) ('**NV**' Mitigation Item references) are also applicable to terrestrial ecology impacts. These measures are also detailed in Chapter 17 (Schedule of Environmental Commitments).

9.6.5 The assessment incorporates essential mitigation required to reduce significant adverse effects which are critical for the delivery of the proposed scheme. Essential mitigation measures for terrestrial ecological features are described in the following sections and include:

- developing a construction lighting plan, species management plans and obtaining protected species licences;
- timing works to avoid sensitive times, e.g. breeding seasons, the hours of darkness, where practicable;
- providing screening to mitigate against visual disturbance from the works;
- undertaking pre-construction surveys and monitoring surveys during construction; and
- provision of a replacement artificial otter holt prior to the closure of the existing holt.

9.6.6 **Mitigation Item ME2** requires that prior to construction, a suitably qualified Ecological Clerk of Works (ECoW) will be appointed by the Contractor and will be responsible for implementation of Species Management Plans which will form part of an Ecological Management Plan.

9.6.7 An ecologist, acting on behalf of Transport Scotland, will check that the Contractor's ECoW is suitably qualified to undertake their role and will audit the contractual obligations with regards to the ecological safeguarding and ecological mitigation requirements. The ecologist will undertake any required ecological monitoring and reporting outwith derogation licences held by the employer and Contractor for the construction.

9.6.8 The ECoW will:

- provide ecological advice over the entire construction programme;
- in collaboration with the ecologist (acting on behalf of Transport Scotland), undertake or oversee pre-construction surveys for protected species in the areas affected by the proposed scheme;
- ensure mitigation measures are implemented to avoid and reduce impacts on ecological features; and
- monitor the implementation of mitigation measures during the construction phase to ensure compliance with protected species legislation and commitments within the EIA Report.

9.6.9 The ECoW will be a member of the CIEEM and will have previous experience in similar ECoW roles. All ECoWs will be approved by Transport Scotland to be appropriately qualified for the role. The ECoW will be appointed in advance of the main construction programme commencing to ensure pre-construction surveys are undertaken and any advance mitigation measures required are implemented, in collaboration with the ecologist (acting on behalf of Transport Scotland).

Construction

9.6.10 Construction mitigation commitments have been produced which set out the actions the Contractor is required to take during the construction phase of the proposed scheme to avoid or reduce environmental impacts. Some measures detailed are not mitigation in isolation, but their implementation for regulatory/legal compliance purposes will inform the scope of further mitigation and licensing where required (e.g. pre-construction surveys and monitoring). Construction mitigation items relevant to Terrestrial Ecology are detailed in Table 9.6 below and in Table 17.5 in Chapter 17 (Schedule of Environmental Commitments).

9.6.11 The mitigation commitments include the requirement for the Contractor to produce a Construction Environmental Management Plan (CEMP) to structure the implementation of the mitigation measures.

9.6.12 In accordance with **Mitigation Item ME1**, the CEMP will include an Ecological Management Plan. An Outline Ecological Management Plan is provided in Appendix A9.4. This will be further developed by the Contractor from the mitigation and environmental commitments identified in this assessment (Table 9.6) and will include, for example:

- any Species Management Plans produced prior to construction;
- details of proposed protection measures, including any required exclusion zones, to avoid any unnecessary encroachment into adjoining areas;
- the scope of pre-construction surveys required prior to and during construction, in accordance with **Mitigation Item TE5**, to verify and, where required, update the baseline ecological conditions set out in the EIA Report;
- restrictions on the timing of construction works, for example during site clearance and main construction works; and
- appropriate watching briefs during construction.

9.6.13 The Ecological Management Plan will be prepared to ensure that essential mitigation strategies required for safeguarding protected species and habitats are implemented as part of the contract. These will be updated as appropriate if any licences and additional mitigation measures are required to avoid potential breaches of conservation legislation arising from mortality or disturbance; or amendments to the agreed mitigation are identified through pre-construction surveys or watching briefs. The plans will be developed in consultation with relevant stakeholders including SNH.

9.6.14 Adherence to the Ecological Management Plan will also mitigate for any potential animal welfare issues during construction.

9.6.15 It will be the contractual responsibility of the Contractor to ensure that mitigation is implemented during the works and that all relevant licences, should they be required, are in place prior to commencement of works. Monitoring of ecological features, and the implementation of the CEMP and Ecological Management Plan, will be undertaken by the ecologist, acting on behalf of Transport Scotland, to audit compliance and record the outcome of the mitigation commitments.

9.6.16 Certain activities will trigger the need for a protected species derogation licence under relevant legislation (**Mitigation Item TE12**). Structures or places which a protected species uses for shelter that are under the footprint of the proposed scheme will be destroyed under licence following consultation with SNH. Works taking place within a certain distance may disturb protected species when occupying a structure of place of shelter and may require a derogation licence. Based on the current baseline, one destruction licence for an otter holt will be required (**Mitigation Item TE13**).

9.6.17 No mitigation is required for non-significant effects. However, Mitigation Items which are to be applied across the proposed scheme will also reduce the effects of these non-significant effects. These have been referenced against the relevant ecological features in Table 9.7.

Operation

9.6.18 A replacement artificial otter holt will be constructed at least six months prior to the closure of the existing holt (**Mitigation Item TE14**). The replacement holt will be located within 500m of the existing holt; for the exact location see Appendix A9.3 (Confidential Ecology Features). The holt will be constructed above ground where there is a suitable route of access, and within 10m from the water's edge to maximise the likelihood of it being found and used by otters. Specifications for the replacement artificial holt will be detailed in a licence application submitted to SNH to destroy the existing holt (**Mitigation Item TE13**) and within a Species Management Plan which will be produced prior to construction of the replacement holt.

Monitoring

9.6.19 The Contractor's ECoW will be responsible for ensuring compliance with protected species legislation and the commitments stated in this assessment, during construction. This will include adherence to the Ecological Management Plan, any Species Management Plans and appropriate mitigation items. An ecologist, acting on behalf of Transport Scotland, will audit compliance and will record the outcome of the mitigation commitments.

9.6.20 During construction, monitoring of bird responses to construction activities will be undertaken by an ecologist, acting on behalf of Transport Scotland, following an adapted methodology based on the wetland bird TTTC surveys (Table 9.1). If required, further mitigation will be proposed and discussed with the ECoW and SNH. Further mitigation could include: amendments to lighting plans and screening placements, and restrictions on works during severe winter weather.

9.6.21 In addition, monitoring surveys will be undertaken by the Contractor's ECoW during peregrine breeding season (March-July inclusive) prior to and/or throughout the construction period to determine if peregrine return to their previous nest or if peregrine move to an alternate nest site.

9.6.22 Monitoring of the replacement otter holt will be undertaken by an ecologist (acting on behalf of Transport Scotland) and is required from its construction, during construction of the proposed scheme and post-construction. Any post-construction monitoring will be undertaken in accordance with the Ecological Management Plan and any Species Management Plans or derogation licences required for the proposed scheme. This monitoring will inform whether further mitigation, maintenance or changes in mitigation approach are required to maintain the conservation status of ecological features.

Schedule of Environmental Commitments

9.6.23 A summary of the essential mitigation measures, to be implemented in constructing and operating the proposed scheme relevant to terrestrial ecology, is provided in Table 9.6. Chapter 17 (Schedule of Environmental Commitments) contains the complete schedule of measures for the proposed scheme.

Table 9.6: Schedule of Environmental Commitments - Terrestrial Ecology

Mitigation Item	Party Responsible for Implementation	Timing of Measure	Description	Mitigation Purpose/Objective	Specific Consultation or Approval Required	Monitoring/ Compliance
TE1	Contractor	Pre-construction & Construction	A construction lighting plan and method statement will be developed by the Contractor. The plan will detail specific mitigation requirements, including but not limited to measures to avoid light spill/reflections, and avoidance of white-blue spectrum and high UV emitting lighting. The lighting plan will take into account published guidance on lighting (e.g. Institution of Lighting Professionals (2011), The Royal Commission on Environmental Pollution (2009) and Bat Conservation Trust and Institution of Lighting Professionals (2018)). The construction lighting design will be developed specifically to avoid illuminating sensitive habitats in locations such as sensitive bird habitats adjacent to the bridge, particularly to the southeast of the piers; watercourses; known commuting routes, and where there is known activity of protected species identified through pre-construction ecological surveys (**Mitigation Item ME1**). Where this is not possible the Contractor will agree any exceptions with the Ecological Clerk of Works (ECoW).	To protect sensitive bird and mammal habitats from illumination.	N/A	The requirement for a construction lighting plan and method statement will be included as an Employer's Requirement in the Contract. The Contractor's ECoW will monitor compliance.
TE2	Designer/ Contractor	Pre-construction & Construction	Monitoring of bird responses to construction activities will be undertaken. Surveys will follow an adapted methodology based on the wetland bird Through The Tide Count (TTTC) surveys (Table 9.1) and will be undertaken by an ecologist acting on behalf of Transport Scotland throughout the construction period. If required, further mitigation will be proposed and discussed with the Ecological Clerk of Works (ECoW) and Scottish Natural Heritage (SNH). Screening of at least 2m in height (such as Heras Readyhoard or Steelhoard Screening fences (Heras 2020)) will be provided between the works and the coastal area throughout winter (September to March). Where possible, and as agreed by the ECoW, screens will be positioned around working areas, including ancillary works/plant such as water treatment tanks, to reduce the visual disturbance caused by operatives, plant and vehicles within the working area. Screens will be in place to mitigate against visual disturbance from the works primarily, but also provide some sound attenuation to limit noise disturbance. The	To avoid significant impacts on qualifying species of the SPA, Ramsar and SSSI, as well as other species of birds present, as a result of the proposed scheme.	N/A	Ecologist (acting on behalf of Transport Scotland) to undertake monitoring surveys. The requirement for screening and CEMP (including species management plans) will be included as an Employer's Requirement in Contract. The Contractor's ECoW will monitor compliance during construction.

Mitigation Item	Party Responsible for Implementation	Timing of Measure	Description	Mitigation Purpose/Objective	Specific Consultation or Approval Required	Monitoring/ Compliance
			screening should be checked by the ECoW prior to works to ensure that the screening has been appropriately placed. The Construction Environmental Management Plan (CEMP) will include a Species Management Plan for wetland birds which will provide further detail on mitigation and monitoring for these species.			
TE3	Contractor	Construction	The Contractor will employ a 'soft-start' to all noisy activities to avoid sudden and unexpected disturbance. Each time the activity is started up after a period of inactivity, the noise levels will be gradually increased over a period of 30 minutes to allow birds (and other animals) to relocate. This will apply year-round.	To avoid sudden and unexpected disturbance to ecological features.	N/A	This mitigation item will be detailed in the CEMP. The Contractor's ECoW will monitor compliance.
TE4	Contractor	Construction	Working during the hours of darkness will be avoided as far as practicable to reduce disturbance to protected species, particularly roosting geese and otter. Working during the hours of darkness will likely be unavoidable during winter, therefore lighting will need to avoid illuminating sensitive bird habitats adjacent to the bridge watercourses; known commuting routes, and where there is known activity of protected species (**Mitigation Item TE1**).	To reduce disturbance to protected species.	N/A	This mitigation item will be detailed in the CEMP. The Contractor's ECoW will monitor compliance
TE5	Designer/ Contractor	Pre-construction	Pre-construction surveys will be undertaken to verify and, where required, update the baseline ecological conditions set out in the EIA Report.	To capture any changes to the baseline which may affect the outcome of the ecological assessment for the proposed scheme.	N/A	The requirement for pre-construction surveys will be included as an Employer's Requirement in Contract.
TE6	Designer/ Contractor	Pre-construction & Construction	Construction work will be programmed, where possible, to commence outside of peregrine breeding season (March to July inclusive). If this cannot be achieved, monitoring surveys will be undertaken to determine if/when peregrine return to their previous nest, or if peregrine move to an alternate nest site, and will commence prior to construction. The natural programme of works should allow for a gradual increase in personnel and noise (e.g. construction of compound first, followed by temporary working platform, temporary bridge and eventually destruction of the piled viaduct)	To avoid significant effects on peregrine during construction works.	Consultation with SNH (if required)	The requirement for the ECoW to undertake surveys and CEMP (including species management plans) will be included as an Employer's Requirement in Contract. The Contractor's ECoW will undertake monitoring

Mitigation Item	Party Responsible for Implementation	Timing of Measure	Description	Mitigation Purpose/Objective	Specific Consultation or Approval Required	Monitoring/ Compliance
			to allow peregrine to habituate so that disturbing works during the breeding season will unlikely disturb peregrine or have implications for the success of the breeding attempt. Although considered unlikely, should significant disturbance be observed by the Ecological Clerk of Works (ECoW), works will stop until further mitigation measures are put in place as determined by the ECoW in consultation with Scottish Natural Heritage (SNH), if required. The Construction Environmental Management Plan (CEMP) will include a Species Management Plan for peregrine which will provide further detail on mitigation for this species.			surveys and monitor compliance during construction.
TE7	Contractor	Pre-construction	Vegetation clearance and the start of construction works should be undertaken outside the core bird breeding season (March to August inclusive) to avoid damage or destruction of occupied nests or disturbance to breeding birds. If this cannot be achieved, an inspection of vegetation to be cleared and the works area (plus a suitable disturbance buffer) for nesting birds will be undertaken by a suitably qualified ecologist no more than 24 hours prior to any works being undertaken. If any nesting birds are identified during the survey, they will be left in situ for their entire nesting period until the young birds have fledged. Alternative approaches to the work will need be proposed e.g. leaving an exclusion zone around the nest to avoid disturbance. All cleared vegetation will be rendered unsuitable for nesting birds, for example, by covering, chipping or removing from works area depending on the end purpose of the vegetation. Vegetation clearance operations such as chipping must be taken in accordance with Scottish Environment Protection Agency's (SEPA) Management of Forestry Waste (WST-G-027) (SEPA 2017) guidance.	To avoid damage or destruction of occupied nests or harm to breeding birds.	N/A	This mitigation item will be detailed in the CEMP. The Contractor's ECoW will monitor compliance
TE8	Contractor	Post-construction	On completion of the works, vegetation cleared to facilitate construction, e.g. scrub removed to permit construction of site access tracks, will be replaced on a like for like basis.	To replace habitat temporarily lost during construction.	N/A	The requirement to replace lost vegetation will be included as an Employer's Requirement in Contract. The

Mitigation Item	Party Responsible for Implementation	Timing of Measure	Description	Mitigation Purpose/Objective	Specific Consultation or Approval Required	Monitoring/ Compliance
						Contractor's ECoW will monitor compliance.
TE9	Contractor	Construction	Trenches, holes and pits will be kept covered at night or provide a means of escape for mammals that may become entrapped.	To avoid mammals becoming trapped during construction.	N/A	This mitigation item will be detailed in the CEMP. The Contractor's ECoW will monitor compliance
TE10	Contractor	Construction	All machinery stored on site and the immediate area (any plant, excavations, etc.) will be checked at the start of each work day to ensure otters are not present.	To mitigate potential direct mortality of otter.	N/A	This mitigation item will be detailed in the CEMP. The Contractor's ECoW will monitor compliance
TE11	Contractor	Pre-construction & Construction	The positioning of construction compounds, storage areas, temporary access tracks etc. and construction works should avoid otter commuting routes as far as practicable.	To mitigate potential direct mortality of otter.	N/A	This mitigation item will be detailed in the CEMP. The Contractor's ECoW will monitor compliance
TE12	Contractor	Pre-construction & Construction	Licences in respect of works necessary to construct the proposed scheme that are likely to breach applicable conservation legislation will be obtained. The Contractor will comply with the requirements or conditions of any granted licence. Licensing may be for the UK and/or European Protected Species.	To comply with conservation legislation.	Approval from SNH and Marine Scotland	The requirement to obtain licences will be included as an Employer's Requirement in Contract. The Contractor's ECoW will monitor compliance.
TE13	Designer	Pre-construction	A licence application will be submitted to Scottish Natural Heritage (SNH) by an ecologist, acting on behalf of Transport Scotland, to permit destruction of the existing holt.	To comply with conservation legislation.	Approval from SNH	N/A
TE14	Designer	Pre-construction & Construction	A replacement artificial otter holt will be constructed at least six months prior to the closure of the existing holt. The replacement holt will be located within 500m of the existing holt on Scottish Ministers land, as agreed; for the exact location see Appendix A9.3 (Confidential Ecology Features). The holt will be constructed above ground where there is a suitable route of access, and within 10m from the water's edge to maximise the likelihood of it being found and used by otters. Specifications for the replacement	To mitigate permanent habitat loss for otter.	Approval from SNH (licence application)	Ecologist (acting on behalf of Transport Scotland) to monitor replacement holt

Mitigation Item	Party Responsible for Implementation	Timing of Measure	Description	Mitigation Purpose/Objective	Specific Consultation or Approval Required	Monitoring/ Compliance
			artificial holt will be detailed in a licence application submitted to Scottish Natural Heritage (SNH) to destroy the existing holt (**Mitigation Item TE13**) and within a Species Management Plan which will be produced prior to construction of the replacement holt.			
Further to the above, the mitigation commitments detailed in Chapter 7 (Road Drainage and the Water Environment) (W), Chapter 8 (Marine Ecology) (ME), and Chapter 12 (Noise and Vibration) (NV) will be implemented to protect terrestrial ecology features, as shown in Table 9.7.						

9.7 Residual Effects

Potential impacts on ecological features without mitigation, mitigation measures and a summary of residual effects are set out in Table 9.7.

Table 9.7: Summary Impact Assessment for Ecological Features

Ecological Feature	Feature Importance	Potential Impact	Potential Effect	Characterisation of Impact (pre-mitigation) & Significance	Mitigation Item	Summary of Residual Effect & Significance (post-mitigation)
Construction						
Firth of Forth SPA, Ramsar and SSSI	International (SPA and Ramsar) National (SSSI)	Temporary loss of saltmarsh habitat to accommodate construction.	Localised fragmentation and displacement of individual birds. This effect would be long-term, reversible and negative.	Major (significant)	**ME4** **ME5** **ME6** **ME7**	No significant residual effects predicted.
		Noise, vibration and light spill associated with construction related activities.	Disturbance leading to displacement of birds from areas used for foraging, loafing and overnight roosting. This may result in additional energy expenditure and loss of conditioning. This effect would be medium-term and negative.	Moderate (significant)	**TE1** **TE2** **TE3** **TE4** **NV2** **NV5**	No significant residual effects predicted.
		Runoff and release of sediment from construction works from accidental spillage.	Pollution of habitat resulting in deterioration of habitat and ultimately direct mortality. Depending on the magnitude of the pollution event there could be irreversible, long-term, negative effects on the habitat and on its qualifying species.	Moderate (significant)	**ME3** **ME7**	No significant residual effects predicted.
		Changes in erosion and deposition around the edge of the raised working platform.	Altered habitat used by qualifying species. The area affected would be minimal and this effect would be short-term, reversible and negative.	Minor (significant)	**ME6** **ME7**	No significant residual effects predicted.
Peregrine	National	Noise, vibration and light spill associated with construction related activities.	Disturbance of Schedule 1 species which could influence breeding success, feeding and behaviour. Peregrine exhibit tolerance and can habituate to disturbances. This effect is unlikely to have an impact on the population of the species.	Moderate (significant)	**TE1** **TE3** **TE5** **TE6** **NV2** **NV5**	No significant residual effects predicted.
Bats	Regional	Noise, vibration and light spill associated with construction related activities.	Disturbance of an EPS, which could lead to avoidance of existing commuting routes and foraging areas, potentially resulting in greater use of less suitable alternatives. This effect would be short-term and negative.	Minor (not significant)	Although effects are not significant, adherence to the following mitigation measures will ensure compliance with species protection legislation and best	No residual effect.

Ecological Feature	Feature Importance	Potential Impact	Potential Effect	Characterisation of Impact (pre-mitigation) & Significance	Mitigation Item	Summary of Residual Effect & Significance (post-mitigation)
					practice guidance, and mitigate the impact: **TE1** **TE4** **TE5** **TE12** **NV2** **NV5**	
Wetland birds (not including qualifying species of the Firth of Forth SPA and Ramsar)	Regional	Temporary loss of saltmarsh habitat to accommodate construction.	Localised fragmentation and displacement of individuals. This effect would be medium-term, reversible and negative.	Major (significant)	**ME4** **ME5** **ME6** **ME7**	No significant residual effects predicted.
		Noise, vibration and light spill associated with construction related activities.	Disturbance leading to displacement of birds from areas used for foraging, loafing and overnight roosting. This may result in additional energy expenditure and loss of conditioning. This effect would be medium-term and negative.	Moderate (significant)	**TE1** **TE2** **TE3** **TE4** **NV2** **NV5**	No significant residual effects predicted.
		Runoff and release of sediment from construction works from accidental spillage.	Pollution of habitat resulting in deterioration of habitat and ultimately direct mortality. Depending on the magnitude of the pollution event there could be irreversible, long-term, negative effects on the habitat and on its qualifying species.	Moderate (significant)	**ME3** **ME7**	No significant residual effects predicted.
		Changes in erosion and deposition around the edges of the working platform.	Altered habitat used by qualifying species. The area affected would be minimal and this effect would be short-term, reversible and negative.	Minor (not significant)	Although effects are not significant, adherence to the following mitigation measures will mitigate the impact: **ME6** **ME7**	No residual effect.
Breeding birds	Regional	Construction related activities, including vehicle movement and vegetation clearance.	Direct mortality during the breeding season.	Minor (not significant)	Although effects are not significant, adherence to the following mitigation measures will	No residual effect.

Ecological Feature	Feature Importance	Potential Impact	Potential Effect	Characterisation of Impact (pre-mitigation) & Significance	Mitigation Item	Summary of Residual Effect & Significance (post-mitigation)
			Mortality of individuals would be a permanent and negative effect. However, this effect is unlikely to occur in sufficient numbers to affect the wider population(s) and would be short-term and negative.		ensure compliance with species protection legislation and best practice guidance, and mitigate the impact: **TE3** **TE5** **TE7** **ME4** **ME7**	
		Noise, vibration and light spill associated with construction related activities.	Disturbance leading to avoidance of habitats and displacement of population(s). This effect would be short-term and negative.	Minor (not significant)	Although effects are not significant, adherence to the following mitigation measures will ensure compliance with species protection legislation and best practice guidance, and mitigate the impact: **TE1** **TE5** **TE7** **ME4** **NV2** **NV5**	No residual effect.
		Temporary loss of habitat to accommodate construction.	Fragmentation and displacement of species. However, the area of habitat temporarily lost would be negligible given the amount of remaining habitat available. This effect is unlikely to have an impact on population(s).	Negligible (not significant)	Although effects are not significant, adherence to the following mitigation measures will mitigate the impact: **TE8** **ME4** **ME5** **ME6** **ME7**	No residual effect.
Otter	Regional	Construction related activities including vehicle movement, temporary bridge and	Direct mortality of individuals moving across site from collisions or entrapment in uncovered holes, pipes or machinery.	Minor (not significant)	Although effects are not significant, adherence to the following mitigation measures will	No residual effect.

Ecological Feature	Feature Importance	Potential Impact	Potential Effect	Characterisation of Impact (pre-mitigation) & Significance	Mitigation Item	Summary of Residual Effect & Significance (post-mitigation)
		replacement piled viaduct construction and excavations.	Permanent negative effect on an individual level but is unlikely to occur in sufficient numbers to affect the wider population and would therefore be short-term and negative.		ensure compliance with species protection legislation and best practice guidance, and mitigate the impact: **TE5** **TE9** **TE10** **TE11** **ME4** **ME7**	
		Noise, vibration and light spill associated with construction related activities.	Disturbance of an EPS, leading to its avoidance of key habitats and fragmentation through temporary loss of habitat; but not at a level that will cause declines in population as the species is widespread in the area. This effect would be short-term and negative.	Minor (not significant)	Although effects are not significant, adherence to the following mitigation measures will ensure compliance with species protection legislation and best practice guidance, and mitigate the impact: **TE1** **TE3** **TE4** **TE5** **TE11** **TE12** **NV2** **NV5**	No residual effect.
		Runoff from construction works from accidental spillage.	Pollution of watercourses resulting in reduced prey availability and a decline in foraging habitat quality. This effect would be short-term, reversible and negative.	Minor (not significant)	Although effects are not significant, adherence to the following mitigation measures will mitigate the impact: **ME3** **ME7**	No residual effect.

Ecological Feature	Feature Importance	Potential Impact	Potential Effect	Characterisation of Impact (pre-mitigation) & Significance	Mitigation Item	Summary of Residual Effect & Significance (post-mitigation)
Operation						
Firth of Forth SPA	International	Construction impacts only.				
Firth of Forth Ramsar	International					
Firth of Forth SSSI	National					
Peregrine	National					
Bats	Regional					
Wetland birds	Regional					
Breeding birds	Regional					
Otter	Regional	Loss of habitat from the footprint of the proposed scheme.	Loss of a known holt used as part of a breeding site. This effect would be permanent and negative.	Major (significant)	**TE13** **TE14**	No significant residual effects predicted.

9.8 Assessment of Policy Compliance

9.8.1 DMRB LA 104 'Environmental assessment and monitoring' (Highways England, Transport Scotland, Welsh Government and Department for Infrastructure Northern Ireland 2019) states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

9.8.2 Appendix A4.1 (Assessment of Policy Compliance) provides a review of national and local policy documents which are of relevance to the assessment undertaken and reported in this chapter in accordance with DMRB guidance.

9.8.3 National planning policy of relevance to this assessment include Scottish Planning Policy (SPP) themes *Valuing the Natural Environment (*Scottish Government 2014), as well as the 2020 Challenge for Scotland's Biodiversity (Scottish Government 2013) and the Environment Strategy for Scotland: Vision and Outcomes (Scottish Government 2020). In addition, local policies of relevance include Falkirk Local Development Plan 2 (FLDP2) Policies PE13 (Green and Blue Network), PE16 (Protection of Open Space), PE19 (Biodiversity and Geodiversity) and PE20 (Trees, Woodland and Hedgerows) (Falkirk Council 2020).

Summary of Policy Compliance

9.8.4 Overall, the design and assessment of the proposed scheme has had regard to and is compliant with policy objectives to minimise impacts on terrestrial ecology. A full policy compliance assessment can be found in Table 4 of Appendix A4.1 (Assessment of Policy Compliance).

9.9 Statement of Significance

9.9.1 Following successful implementation of the Saltmarsh Management Plan, recovery of the habitat will be long-term but re-establishment to the current NVC community is predicted. It is anticipated that there will not be any significant residual effects as a result of construction or the operation of the proposed scheme.

9.10 References

European and National Legislation

Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland)

The European Union Directive (92/43/EEC) on the Conservation of natural habitats and of wild fauna and flora (Habitats Directive) (1992).

The European Union Directive on the Conservation of wild birds (79/409/EEC) (1979).

Nature Conservation (Scotland) Act 2004

Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat (1971)

The Roads (Scotland) Act 1984 (Environmental Impact Assessment) Regulations 2017, Draft SI

Wildlife and Countryside Act 1981 (as amended)

Reports and Documents

Amphibian and Reptile Group UK (2010). ARG UK Advice Note 5: Great Crested Newt Habitat Suitability Index. Amphibian and Reptile Groups of the United Kingdom.

Bat Conservation Trust and Institution of Lighting Professionals (2018) Guidance Note 08/18 Bats and artificial lighting in the UK Bats and the Built Environment series [Online] Available from: https://cdn.bats.org.uk/pdf/Resources/ilp-guidance-note-8-bats-and-artificial-lighting-compressed.pdf?mtime=20181113114229 [Accessed May 2020]

Bibby, C., Burgess, N.D., Hill, D. and Mustoe, S. (2000). Bird Census Techniques. Second Edition, Academic Press, London, England.

BTO (2008). BTO Species Codes [Online] Available from www.bto.org/sites/default/files/u16/downloads/forms_instructions/bto_bird_species_codes.pdf [Accessed September 2018].

BTO (2014). Peregrine Survey – Latest Results. [Online]
Available from www.bto.org/volunteer-surveys/peregrine-survey/results [Accessed September 2018].

BTO (2020). Barn owl [Online] Available from https://www.bto.org/our-science/projects/project-owl/learn-about-owls/barn-owl [Accessed September 2020].

Chanin, P. (2003). Ecology of the European Otter Conserving Natura 2000 Rivers. Ecology Series No.10 English Nature, Peterborough.

CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.

CIRIA (2015). Coastal and marine environmental site guide (second edition).

Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Edition). The Bat Conservation Trust, London.

Eaton, M., Aebisher, N., Brown, A., Hearn, R., Loch, L., Musgrove, A., Noble, D., Stroud, D., and Gregory, R. (2015). Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and

Isle of Man. British Birds 108, pp708-746.

Falkirk Council. (2016). Local Nature Conservation and Geodiversity Sites. Supplementary Guidance SG08.

Falkirk Council (2019). Second Nature A Biodiversity Action Plan for the Falkirk Council area. Published March 2019. [Online] Available from http://www.falkirk.gov.uk/services/environment/environmental-management/biodiversity.aspx [Accessed January 2020].

Falkirk Council (2020). Falkirk Local Development Plan 2.

Fife Biodiversity Partnership (2013). Fife Local Biodiversity Action Plan. 2013-2018 Fourth Edition. [Online] Available from https://beautiful.fife.scot/beautifulfife/wp-content/uploads/sites/6/2016/10/c64_FBLAP-final.pdf [Accessed September 2020].

Gilbert, G., Gibbons, D.W. and Evans, J. (1998). Bird Monitoring Methods: A Manual of Techniques for Key UK Species. Pelagic Publishing.

Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. and Thompson, D. (2013). Raptors: A Field Guide for Surveys and Monitoring. Third Edition. Scottish Natural Heritage.

Heras (2020). Heras Mobile Fencing & Security. Available from https://www.heras-mobile.co.uk/ [Accessed January 2020]

Highways Agency, Scottish Government, Welsh Assembly Government and The Department of Regional Development Northern Ireland (1993). Design Manual for Roads and Bridges, Volume 11, Section 3, Part 4. Ecology and Nature Conservation.

Highways Agency, Scottish Government, Welsh Assembly Government and The Department of Regional Development Northern Ireland (2010). Interim Advice Note 130/10 'Ecology and Nature Conservation: Criteria for Impact Assessment'.

Highways England, Transport Scotland, Welsh Government, and Department for Infrastructure Northern Ireland (2019). Design Manual for Roads and Bridges, LA 104 Environmental assessment and monitoring, Revision 1.

HM Government (2018). A Green Future: Our 25 Year Plan to Improve the Environment.

Institution of Lighting Professionals (2011). Guidance Notes for the Reduction of Obtrusive Light GN01:2011 [Online] Available from https://www.theilp.org.uk/documents/obtrusive-light/ [Accessed January 2019]

Jacobs (2009). Kincardine Bridge Refurbishment: Environmental Review.

Jacobs (2018). A985 Kincardine Bridge Refurbishment Scoping Report.

Jacobs (2020) (On behalf of Transport Scotland). A985 Kincardine Bridge Refurbishment: Piled Viaduct Replacement Scheme. Habitats Regulations Appraisal.

JNCC (2010). Handbook for Phase 1 Habitat Survey - a Technique for Environmental Audit. Reprinted by JNCC, Peterborough.

JNCC (2013a). Supporting documentation for the Third Report by the United Kingdom under Article 17 S1355 Otter (*Lutra lutra*). JNCC, Peterborough [Online]
Available from jncc.defra.gov.uk/pdf/Article17Consult_20131010/S1355_SCOTLAND.pdf [Accessed September 2018].

JNCC (2013b). Supporting documentation for the Third Report by the United Kingdom under Article 17 S1309 Common pipistrelle (*Pipistrellus pipistrellus*). JNCC, Peterborough [Online] Available from jncc.defra.gov.uk/pdf/Article17Consult_20131010/S1309_SCOTLAND.pdf [Accessed September 2018].

JNCC (2013c). Supporting documentation for the Third Report by the United Kingdom under Article 17 S5009 Soprano pipistrelle (*Pipistrellus pygmaeus*). JNCC, Peterborough [Online] Available from jncc.defra.gov.uk/pdf/Article17Consult_20131010/S5009_SCOTLAND.pdf [Accessed September 2018].

JNCC (2013d). Supporting documentation for the Third Report by the United Kingdom under Article 17 S1326 Brown long-eared bat (*Plecotus auritus*). JNCC, Peterborough [Online] Available from jncc.defra.gov.uk/pdf/Article17Consult_20131010/S1326_SCOTLAND.pdf [Accessed September 2018].

JNCC (2013e). Supporting documentation for the Third Report by the United Kingdom under Article 17 S1314 Daubenton's bat (*Myotis daubentonii*). JNCC, Peterborough [Online] Available from jncc.defra.gov.uk/pdf/Article17Consult_20131010/S1314_SCOTLAND.pdf [Accessed September 2018].

JNCC (2018). Website [Online] Available from www.jncc.defra.gov.uk/ [Accessed September 2018].

Marchant, J.H. (1983). BTO Common Birds Census instructions. BTO, Tring.

National Biodiversity Network (NBN) Atlas Partnership (2018). NBN Atlas Scotland [Online] Available from www.scotland.nbnatlas.org/ [Accessed September 2018].

Oldham R.S., Keeble, J., Swan, M.J.S. and Jeffcote, M. (2000). Evaluating the Suitability of Habitat for the Great Crested Newt (*Triturus cristatus*). Herpetological Journal, Vol. 10, pp. 143-155.

Rose, P.M. & Scott, D.A. (1997). Waterfowl Population Estimates – Second Edition. Wetlands International Publication No. 44, Wageningen, The Netherlands

RSPB (2018a). Inner Forth: Reserves [Online] Available from www.rspb.org.uk/our-work/conservation/landscape-scale-conservation/sites/inner-forth/ [Accessed September 2018].

RSPB (2018b). Shelduck [Online] Available from www.rspb.org.uk/birds-and-wildlife/wildlife-guides/bird-a-z/shelduck/ [Accessed September 2018].

Scottish Executive (2003). Upper Forth Crossing at Kincardine: Environmental Statement.

Scottish Executive (2004). Scotland's Biodiversity: It's in Your Hands [Online] Available at: www.gov.scot/Resource/Doc/25954/0014583.pdf [Accessed September 2018].

Scottish Government (2000). Planning Advice Note 60: Planning for Natural Heritage.

Scottish Government (2013). 2020 Challenge for Scotland's Biodiversity A Strategy for the conservation and enhancement of biodiversity in Scotland. Scottish Government, Edinburgh.

Scottish Government (2017). Revision 1.0 Planning Advice Note 1/2013: Environmental Impact Assessment.

Scottish Government (2020). The Environment Strategy for Scotland: Vision and Outcomes.

Scottish Wildlife Trust (2018). Pink-footed goose *Anser brachyrhynchus* [Online]
Available from scottishwildlifetrust.org.uk/species/pink-footed-goose/ [Accessed September 2018].

SEPA (2017). Management of Forestry Waste. WST-G-027 version 3.

SNH (2016). Habitats Regulations Appraisal (HRA) on the Firth of Forth; a Guide for developers and regulators [Online] Available from https://www.nature.scot/sites/default/files/2017-06/A1979038%20-%20Habitats%20Regulations%20Appraisal%20(HRA)%20on%20the%20Firth%20of%20Forth%20-%20A%20Guide%20for%20developers%20and%20regulators.pdf [Accessed January 2019].

SNH (2017). Standing Advice for Planning Consultations. Protected Species: GCN [Online] Available from https://www.nature.scot/sites/default/files/2019-10/Species%20Planning%20Advice%20-%20Great%20crested%20newt.pdf [Accessed July 2020].

SNH (2018a). Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland. 5th Edition. Scottish Natural Heritage, Battleby, Perth.

SNH (2018b). Scottish Natural Heritage Information Service Sitelink [Online]
Available from https://sitelink.nature.scot/home [Accessed September 2018].

SNH (2018c). Site Details for Firth of Forth SPA [Online]
Available from https://sitelink.nature.scot/site/8499 [Accessed September 2018].

SNH (2018d). Site Details for Firth of Forth Ramsar [Online]
Available from https://sitelink.nature.scot/site/8424 [Accessed September 2018]

SNH (2018e). Site Details for Firth of Forth SSSI [Online]
Available from https://sitelink.nature.scot/site/8163 [Accessed September 2018].

SNH (2018f). Site Details for River Teith SAC [Online]
Available from https://sitelink.nature.scot/site/8367 [Accessed September 2018].

SNH (2020). Pine Marten [Online] Available from https://www.nature.scot/plants-animals-and-fungi/mammals/land-mammals/pine-marten [Accessed September 2020].

The Royal Commission on Environmental Pollution (2009). Artificial Light in the Environment. The Stationery Office, Norwich, UK.

Wilkinson, J.W., Arnell, A., Driver, D. and Driver, B. (2014). Elaborating the distribution of the great crested newt in Scotland (2010-2011). Scottish Natural Heritage Commissioned Report No. 793.