A10.7 Terrestrial and Freshwater Ecology - Impacts and Mitigation

This appendix presents a description of potential impacts and associated mitigation measures, supporting the summary presented in Chapter 10 (Sections 10.4 to 10.6). It also describes residual impacts likely to occur to habitats and species as a result of construction and operation of the proposed scheme.

1. General Impacts

1.1.1 There are a number of potential impacts associated with any major road and/or bridge scheme. Construction can lead to the death of sessile and slow-moving organisms, injure organisms adjacent to the road and alter physical conditions beneath the road. Vehicle collisions due to a road scheme once operational can affect the demography of many species of both vertebrates and invertebrates. Roads and bridges can alter animal behaviour by causing changes in home ranges, movement, reproductive success, escape response and physiological state. Infrastructure can also change soil density, temperature, soil water content, light levels, dust, surface waters, patterns of run-off, and sedimentation, as well as adding heavy metals (especially lead), salts, organic molecules, ozone and nutrients to roadside environments.

1.1.2 Not all species and ecosystems are equally affected by large scale infrastructure, but overall its presence is highly correlated with changes in species composition and population sizes, as well as hydrologic and geomorphic processes that shape marine, aquatic and riparian systems.

2. Description of General Impacts

2.1 Terrestrial Habitats

2.1.1 A summary of the potential general impacts on terrestrial habitats arising from the construction and operation of road infrastructure is provided below.

Habitat Loss

Construction and Operation

2.1.2 There will be temporary habitat loss during construction of the proposed scheme due to the provision of land for access roads, site compounds, borrow pits, storage of construction materials or similar. In addition, permanent habitat loss or habitat change would occur as a result of the new road infrastructure, including the footprint of the road carriageway, land required for drainage treatment and areas of earthworks.

Disturbance

Construction

2.1.3 Disturbance to habitats could occur as a result of noise and activity during construction. Disturbance to species' activities and movements across the works corridor could also occur.

Habitat Fragmentation and Isolation

Construction

2.1.4 Fragmentation could occur during construction as a result of site compounds and associated infrastructure, such as haul roads.

Operation

2.1.5 Fragmentation of habitats can occur where infrastructure severs existing habitat resulting in the physical obstruction to the natural movement of animal populations.

Pollution

Construction

2.1.6 During construction, potential for terrestrial habitat pollution is likely to be predominantly associated with run-off of construction materials onto semi-natural habitats. This could result in adverse impacts to these habitats.

2.1.7 During construction, particulate deposition of material arising from construction materials could result in limited impacts close to the construction site.

Operation

2.1.8 During the operation, pollution resulting from road drainage, run-off and spray could adversely affect adjacent habitats. Visual and light pollution impacts on existing habitats are possible, with the magnitude dependent on the level of road lighting present in specific areas. Similarly, air pollution could arise from traffic emissions.

Air Quality Impacts on Designated Sites

Operation

2.1.9 A background to air quality, the selection of ecologically sensitive receptors and information in respect to NOx and nitrogen deposition with regards to potential impacts on identified ecological receptors is presented in Section 15.2 - 15.4 (Chapter 15: Air Quality).

Hydrological Disruption

Construction

2.1.10 Wetland habitats including mires, swamp and reedbeds are susceptible, in the short-term, to impacts from developments that affect the hydrological regimes of those habitats.

Operation

2.1.11 Wetland habitats close to infrastructure are susceptible to hydrological changes during operation which could lead to the degradation or loss of these habitat types.

Alien Species Transfer

Construction

2.1.12 It is an offence under Section 14 of the Wildlife and Countryside Act (WCA) 1981 (as amended), to grow any plant which is not ordinarily resident in Great Britain or which is a known threat and listed on Schedule 9 of the Act. In addition, Japanese knotweed (*Fallopia japonica*) or giant hogweed (*Heracleun mantegazzianum*) contaminated soil or plant material for disposal is likely to be classified as "controlled waste" under Part II of the Environmental Protection Act 1990 and under Section 1a and 1b of this Act it is an offence to deposit, treat, keep or dispose of controlled waste without a licence. In the absence of mitigation, it is possible that the transfer of alien species will occur during earthmoving, the creation and use of proposed temporary access roads and site compounds, and during works close to waterbodies. In addition, the transfer of alien species could

result in a direct negative impact on native flora with an indirect impact on native fauna through a reduction of biodiversity.

Provision of Structures

Operation

2.1.13 The provision of new structures has potential to cause shading, which could result in a change in species composition and loss of cover.

2.2 Badger

Direct Mortality

Construction

2.2.1 Badgers are naturally inquisitive animals and may investigate construction sites during the night. There is therefore an increased probability of mortality through badgers becoming trapped in any pits, piping, fuel containers, wire mesh or similar hazards. Night works may also lead to badgers being run over by works vehicles without the implementation of appropriate mitigation. Earthworks or the construction compounds could lead to the destruction of badger setts and the death of any badgers inside, particularly where sett locations are unknown. This would constitute an offence under current legislation.

Operation

2.2.2 The principal cause of badger death during the operational stage of any road scheme is as a result of badgers being struck by traffic (road traffic accident (RTA)) as they attempt to cross new roads. Badgers are particularly susceptible where roads sever existing paths or foraging areas.

Habitat Loss

Construction and Operation

2.2.3 New roads infrastructure could result in the loss of agricultural and semi-natural habitats, which potentially represents important setting, foraging and commuting habitat for badgers. Therefore, social groups could potentially be displaced from their home range leading to increased territorial conflict with neighbouring social groups.

2.2.4 Edge effects could result in areas of habitat adjacent to infrastructure being avoided or certain setts being abandoned by badgers, due to disturbance effects. The impacts of habitat loss during the operational phase could vary between social groups, depending on the extent by which their territory is affected.

Habitat Fragmentation and Isolation

Construction

2.2.5 Construction is unlikely to result in severance as badgers would generally be able to move freely across the carriageway before it is operational. Temporary localised fragmentation of individual badger groups' territories could result through disturbance or the construction of temporary barriers such as the fencing of construction corridors.

Operation

2.2.6 The operational phase of road infrastructure could result in the fragmentation of badger territories through the physical barrier effect resulting from the presence of the new road. This fragmentation

may result in badgers being isolated from other areas of their territory such as key foraging locations. Any reduction in available resources may in turn lead to an increase in territorial conflict between neighbouring social groups. Badgers are capable of inflicting fatal injuries on each other during territorial disputes (Neal & Cheeseman, 1996) and this may indirectly add to the impacts related to direct mortality.

2.2.7 The barrier effects of road infrastructure could also restrict immigration and emigration of individuals between social groups, which has been shown in other species to decrease genetic dispersal and potentially leading to increased inbreeding (Madsen et al., 1996).

2.2.8 Fragmentation effects of road infrastructure could render some areas of habitat unviable in terms of their ability to function as a complete resource for badgers. The fragmentation of woodland may make it unsuitable for setting habitat or affect its ability to function as an economic foraging resource through a decrease in overall productivity or species diversity.

Disturbance

Construction

2.2.9 Machinery and works activities during construction can cause temporary increases in disturbance to badgers. Night-time working involving lighting, noise and human presence could deter badgers from using land around a works site in the short-term, although badgers generally become accustomed to this (Neal & Cheeseman, 1996). Stores of materials or plant next to an already installed badger-pass could dissuade badgers from using the pass, especially if the plant is used regularly. Similarly, activities during the daytime near breeding setts could cause serious disturbance to badgers and mortality of cubs (NRA, 2005). Under current guidance from SNH (SNH, 2001) any works activities within 30m of a badger sett could result in an offence and works would need to be carried out under licence. Some activities such as blasting can cause major disturbance and could affect a larger zone. The requirement for a disturbance licence is based on SNH guidance, professional judgment and on a case by case basis. Any necessary sett exclusions would also result in temporary disturbance while badgers move to the new sett.

Operation

2.2.10 Noise and light pollution may lead to some disturbance adjacent to infrastructure which can deter badgers from foraging or maintaining setts. However, regular disturbance by noise and light pollution seems to have little effect on badgers as they quickly become habituated (Neal & Cheeseman, 1996).

Pollution and Other Indirect Impacts

Construction

2.2.11 During construction, materials such as petrochemicals, lubricants and solvents used for plant and general works may cause an increased risk of badger mortality by means of poisoning through the potential contamination of waterbodies used by badgers for drinking. Similarly, there is the potential for the contamination of terrestrial habitats leading to a bio-accumulation of contaminants in food resources such as earthworms and rhizomes (Neal & Cheeseman, 1996). High levels of pollutants could therefore accumulate in badgers, possibly affecting reproductive success and reducing survival rates.

Operation

2.2.12 Run-off from road infrastructure may contain toxic chemicals including zinc, cadmium and copper, in addition to compounds such as polychlorinated biphenyls (PCBs) and petrochemicals which may have the potential to affect mammalian reproductive rates (Kruuk, 2006).

2.3 Bats

Direct Mortality

Construction and Operation

2.3.1 Bats are relatively long-lived, taking several years to reach reproductive maturity and then producing only one offspring a year. They therefore invest considerable energy into producing relatively few young compared with other similar-sized terrestrial mammals. This reproductive strategy makes bat populations particularly susceptible to impacts that compromise their numbers or ability to reproduce (Kunz, 1982).

2.3.2 Pre-construction vegetation clearance could result in the direct mortality of bats through the destruction of breeding, resting, roosting or hibernation places. During the operation of any road scheme there is a risk of RTAs caused by collision with vehicles.

Habitat Loss

Construction and Operation

2.3.3 Bats are particularly sensitive to habitat loss, and even small patches of habitat may have wide-ranging implications for the bats that use them (Highways Agency et al., 1993). High roost fidelity and roost selectivity in certain species mean that loss of roost sites could be detrimental to the populations using them. In particular this could be manifested by the selection of sub-optimal roost sites which could influence survival rates, especially at sensitive times of year including during hibernation or breeding.

2.3.4 Optimal habitats include broad-leaved woodland, habitat corridors and lacustrine/riverine habitats. These are relatively rare nationally and their distribution scattered and localised (Walsh et al., 1996a and 1996b). As a result, bat populations are likely to be susceptible to loss of these habitats.

2.3.5 Bats use linear features such as rivers, hedgerows and tree lines as commuting routes between roosts and foraging grounds (Limpens & Kapetyn, 1991) and it is the integrity of these habitat features that is considered to be critical to the viability of bat populations (Mitchell-Jones & McLeish, 1999).

Habitat Fragmentation and Isolation

Construction and Operation

2.3.6 Many of the impacts of habitat fragmentation and isolation are common to the construction and operation phases, and also to the impacts of habitat loss and direct mortality. Impacts include the loss of hedges, fences and tree lines. These features are used for navigation by bats such as pipistrelle and *Myotis* species, and brown long-eared bats (Limpens & Kapetyn, 1991). In particular, loss of these features could impact on low flying bats, causing the isolation of resources and increasing the effort needed to commute between suitable foraging and roosting areas. This could be exacerbated by the patchiness of roosts and foraging areas used by bats.

2.3.7 Severance of commuting corridors and removal of sheltered flyways between patches could affect access to resources and could therefore affect long term survival of populations of bats, particularly where this occurs within 100m of a maternity roost, as pregnant females may need to feed closer to the roost (Racey & Speakman, 1987).

Disturbance

Construction and Operation

2.3.8 The effects of disturbance are likely to be most pronounced during construction, in particular during felling and demolition works, as bats will modify their behaviour to accommodate disturbance over time.

Pollution

Construction and Operation

2.3.9 The effects of pollution on local watercourses, from accidental spills during construction and road run-off during operation, could potentially destroy or degrade the value of wetland feeding areas for bats.

Changes in Hydrology

Construction and Operation

2.3.10 Road schemes which cause draw-down or other disruptions to the local hydrology could potentially alter the suitability of or degrade wetland feeding areas for bats.

Artificial Lighting

Construction and Operation

2.3.11 Road lighting has the potential to attract insects and is considered a reliable food source, and while *Plecotus* and *Myotis* species tend to avoid lights to escape predation from birds, pipistrelle bats will swarm around lamps and feed on insects (Rydell & Racey, 1993). However, such behaviour may be associated with an increased risk of road traffic casualties as well as an increased risk of predation (Highways Agency et al., 1993).

2.4 Terrestrial Breeding and Wintering Birds

Direct Mortality

Construction

2.4.1 Habitat loss resulting from clearance of vegetation prior to construction is unlikely to result in direct mortality of adults or fledged young since they are able to escape by moving into unaffected adjacent habitats. Bird eggs and un-fledged young however are vulnerable to direct mortality associated with habitat loss, particularly in habitats such as dense scrub, grassland or woodland, as nests cannot be easily detected.

2.4.2 Direct mortality can result from disturbance by the presence of workers and construction activities which may cause a lack of breeding success if adult birds are not able to spend sufficient time incubating eggs or tending dependant young.

2.4.3 Direct mortality of bird eggs and young from habitat loss and disturbance would occur during the breeding season, typically March - August, and could constitute an offence under the WCA 1981 (as amended).

Operation

2.4.4 Many bird species will attempt to cross active roads to move between habitat fragments that arise as a direct result of operational habitat fragmentation and isolation (Slater, 1994).

2.4.5 An increase in direct mortality resulting from habitat fragmentation associated with an increase in number of roads and road traffic within the UK has been highlighted as a major component in the decline of some bird species such as the barn owl (*Tyto alba*). It has been observed that twice as many barn owls are now killed by road traffic on UK roads as compared with the 1950s and in some areas suitable habitat no longer supports barn owl populations (English Nature, 1996).

2.4.6 Roads can also create unexpected secondary sources of mortality; for example there have been several documented cases of bird mortality from road salt. Finches, in particular, are attracted to salt, probably to satisfy a dietary need. This can cause mortality through vehicle collision and also through the toxic effects of the ingested salt (Mineau & Brownlee, 2005).

2.4.7 By contrast, some bird species actively benefit from living near roads such as certain members of the corvid family, for example magpie (*Pica pica*) and carrion crow (*Corvus corone*), which regularly scavenge on road kills (Slater, 1994) and common kestrel (*Falco tinnunculus*), which hunt for small rodents along suitable roadside verges. However, none of these species are considered to be of conservation concern.

Habitat Loss

Construction and Operation

2.4.8 The direct impact of road construction is the physical loss of breeding and foraging habitats along a route corridor, which are replaced or altered by transport infrastructure. The impacts associated with direct habitat loss are additionally increased by the interaction of disturbance and fragmentation/isolation impacts which if combined, can lead to a change in the distribution of species within a route corridor or wider study area (Iuell et al., 2003).

2.4.9 Pre-construction habitat clearance could result in the destruction of potential breeding habitat for bird species. Cumulative impacts are also likely to arise as a consequence of the destruction of birds' eggs, direct mortality of un-fledged young and the displacement of adults and fledglings by means of disturbance into adjacent unaffected habitat.

2.4.10 Habitat clearance could additionally result in the direct loss of foraging habitat through the loss of plant food groups such as buds or berries and the indirect loss of invertebrate communities, which form a major dietary constituent for the majority of small to medium sized bird species (e.g. blue tit (*Cyanistes caeruleus*) or song thrush (*Turdus philomelos*)).

2.4.11 Removal and clearance of surrounding vegetation possibly alter the available shelter for breeding birds increasing vulnerability to a range of external factors such as adverse weather conditions and predators.

2.4.12 Habitat loss associated with the construction and use of site compounds and other temporary structures such as access tracks, bridges or storage areas, could result in the temporary loss of potential breeding bird habitat, the effects of which are described above. The level of permanence of loss would vary and depend on the location.

2.4.13 Road operation could result in a reduction in the abundance of invertebrate communities within the immediate vicinity, in particular as a result of pollution. Pollution may include road salting, oil and fuel spillage, resulting in an indirect impact to bird populations through a reduction in food availability.

Habitat Fragmentation and Isolation

Construction and Operation

2.4.14 Construction and operation of road infrastructure is unlikely to have significant fragmentation and isolation impacts on bird populations.

Disturbance

Construction

2.4.15 Disturbance resulting from noise and vibration associated with construction of infrastructure would be likely to occur in two stages. The first stage would comprise disturbance resulting from pre-construction habitat clearance. The second stage would comprise additional disturbance, for example, from rock chipping/possible blasting or from human activity. Disturbance contributes to an increase in the effects of fragmentation and isolation which could lead to some species of bird failing to nest during the breeding season (March - August).

Operation

2.4.16 Disturbance responses of birds to light and noise vary between species and for a given species. The response to noise also depends on levels of ambient noise in the environment they occupy and the extent to which noise levels are increased by a given activity. Activities which result in increases in noise levels above ambient noise could cause disturbance to birds. Overall, the evidence points to rapid and successful habituation to new noise sources but also to the fact that birds are more affected by startle than long term changes in noise levels.

2.4.17 Research shows that birds with low frequency calls such as corvids, owls and doves are often abundant in close proximity to roads (Slabbekoorn & Ripmeester, 2008). Wading species such as the common ringed plover have also been reported to occur in greater numbers near towns and road networks (Burton et al., 2002).

2.4.18 Disturbance resulting from noise and vibration is mainly influenced by traffic type, traffic intensity, road surface properties, topography and structure/type of adjacent vegetation, which is in turn influenced by underlying geology and soil characteristics (Iuell et al., 2003). It is therefore likely that disturbance could result from light, noise and vibration associated with operational lighting, road traffic and occasional operational maintenance.

Pollution and Other Indirect Impacts

Construction

2.4.19 Accidental spills of chemicals and other potentially toxic substances during construction may occur and are of particular concern if they happen within proximity of ecologically sensitive communities or rivers and streams, especially if they form part of, or are a tributary to, a designated site. The severity and extent of the pollution impact would depend on the constituents, toxicity to biodiversity and discharge volume of the pollutant.

Operation

2.4.20 Pollutants and toxins derived from road traffic and road surfaces contain a number of pollutants including carbon monoxide, nitrogen oxide, sulphur dioxide, hydrocarbons, dioxins, lead and cadmium. These chemicals and gases can potentially pollute surface and groundwater, soil and vegetation (Iuell et al., 2003).

2.4.21 Accidental spills of chemicals and other potentially toxic substances during operation may occur as a consequence of inadvertent discharge or indirectly as a result of road traffic accidents. As with the construction phase, these pollution incidents are of particular concern if they happen within proximity of ecological sensitive communities or rivers and streams.

2.4.22 Little information is available on the direct impacts of operational roads on the abundance of invertebrate communities and the indirect impacts on bird species through a reduction in food availability.

2.5 Otter

Direct Mortality

Construction

2.5.1 Otters are inquisitive animals and may be attracted onto work sites during the construction phase to investigate new machinery or spoil heaps (Highways Agency et al., 1993). In the absence of mitigation, otters risk becoming trapped in pits, piping, chemical containers or wire mesh. As otters are largely nocturnal, any night works may also lead to their being run-over by works vehicles. Such events are not common (Grogan et al., 2001), however, the otter's conservation status means that such an incident could constitute an important impact in terms of otter populations (Appendix A10.2, Section A10.2.7).

Operation

2.5.2 Of all recorded otter deaths in Scotland, 86% are being attributed to road accidents (Green & Green, 1997). The majority of road casualties occur within 100m of a watercourse and during high water levels (Philcox et al., 1999). In periods of flood, otters may be reluctant or unable to swim under bridges or through culverts due to strong currents, high flows and no safe passage above ledge high water mark. Where otters do attempt to swim under the road during strong currents, they are liable to drowning, especially in culverts that have become blocked at one end or where there is a lack of air space. RTAs may be increased where drainage ditches and burns run alongside the road, as otters can be attracted onto the carriageway (Grogan et al., 2001).

2.5.3 Infrastructure could adversely affect otters where new roads cross or come in close proximity to watercourses that are utilised by otters. It is possible that dispersing sub-adults and females could be killed and females and juveniles in particular are vital in maintaining the population.

Habitat loss

Construction and Operation

2.5.4 Otters are secretive mammals and lying up sites within their home range are very important. The loss of holts and other lying up sites will therefore place more stress on the animals, requiring them to travel further in order to find suitable cover. This may create conflict with other otters or put them at risk to other hazards such as RTAs (Highways Agency et al., 1993).

2.5.5 Temporary access roads, construction and storage compounds and watercourse diversions and realignments have the potential to reduce the availability of otter habitat. Further loss of habitat could occur during the excavation of cuttings and the construction of embankments and bridges.

2.5.6 Under the relevant legislation an offence would be committed if construction works were to obstruct access to any otter lying up site, disturb an otter in its lying up site, or damage or destroy a lying up site (Appendix A10.2: Section A10.2.7).

2.5.7 Infrastructure also has the potential to result in impacts to otter through the indirect loss of habitat through impacts on local hydrology.

Habitat Fragmentation and Isolation

Construction

2.5.8 The siting of construction compounds, storage facilities and access roads close to watercourses and features which otters use to travel through the landscape may result in potential impacts by obstructing otter movements within and between existing areas of habitat. In addition, commuting routes may be severed and otters may become more susceptible to being killed on existing roads

through RTAs. This may also reduce access to the upper reaches of watercourses, limiting foraging areas or increasing competition with other otters (Highways Agency et al., 1993).

Operation

2.5.9 In the absence of mitigation the operational road infrastructure would form a physical barrier to otters, preventing them from moving freely within and between available areas of habitat, including newly colonised areas and breeding grounds. Road infrastructure would therefore divide otters' home ranges, possibly causing them to abandon parts of their range. This could increase the likelihood of road crossings and subsequently the risk of RTAs as otters attempt to reach foraging and lying up areas on the other side. Severance of otter home ranges may place them in direct competition with other otters, increasing stress and causing otters to inflict serious and potentially fatal injuries on each other during disputes over territory (Grogan et al., 2001). Roads may also act as a barrier restricting immigration and emigration thus decreasing genetic dispersal and increasing competition amongst currently stable populations.

Disturbance

Construction

2.5.10 Noise from machinery and vehicles, light for night working, the possible obstruction of holts and otter pathways and the presence of humans can all have adverse impacts on otter behaviour.

2.5.11 Under the relevant legislation it would be an offence to obstruct access to a holt, disturb an otter in a holt or damage/destroy a holt or couch (Appendix A10.2, Section A10.2.7).

2.5.12 Otters may attempt to avoid any periodic disturbance, which will act as a barrier to their usual activities and deter them from using lying up sites, resulting in the effective loss of these sites. This may cause otters to use different routes that may bring them into conflict with other otters or they may use a route that involves crossing other roads with associated RTA risk. Otters may also be prompted to forage further away if available foraging habitat is reduced.

2.5.13 Moreover, as otters have no fixed breeding season, holts and couches may be occupied at any time of the year. Any disturbance could result in a female otter abandoning her cubs, which is likely to result in their death if they are still dependant on their mother i.e. during the first three months of their life (Highways Agency et al., 1993).

Operation

2.5.14 Otters are likely to suffer disturbance from traffic noise as well as from road lighting during the operational phase. Otters may become accustomed to these impacts over time but otters could abandon any holts or couches in the immediate vicinity of the road infrastructure.

Pollution and Other Indirect Impacts

Construction

2.5.15 Accidental spillages e.g. from oil and diesel drums may directly reduce the abundance of available otter prey items and a particularly severe spillage may lead to a bio-accumulation of contaminants in prey species which would result in identified impacts. High levels of pollutants may therefore accumulate in otters resulting in mortality. Being carnivores, otters are particularly vulnerable to changes in food availability at all levels of the food chain. Pollutants such as oil and diesel can also cause death by affecting the thermo-regulation qualities of an otter's coat (Kruuk 1995; Grogan et al., 2001).

2.5.16 Pollution of watercourses and water features in the area could result in serious long-term damage to the productivity and diversity of nearby habitats, with a negative impact on both otters and their

food supply. The construction of bridges and culverts as part of road schemes may cause restrictions in watercourse channels, which can cause scouring and flooding, cumulating in sediment deposition downstream and a reduction in aquatic invertebrate numbers. This would have an adverse impact on fish populations, which in turn could affect otter prey availability (Grogan et al., 2001).

Operation

2.5.17 Without mitigation, pollution from roads during occurrences of storm water run-off or accidental spillage (Kruuk, 1995) would have similar impacts to those described for the construction phase. Run-off from the road may contain toxic chemicals such as zinc, cadmium and copper. Compounds such as PCBs could also be present, which have the potential to affect mammalian reproductive rates (Grogan et al., 2001).

2.5.18 Reduced water quality due to higher levels of traffic and accidental spills may cause reductions in food availability for otter. The edge effects of infrastructure have the potential for increasing the overall habitat loss associated with the road. Spray and road run-off polluted with contaminants could have effects on soils and local water quality in adjacent areas, making them unsuitable for wetland plant species.

2.6 Amphibians

Direct Mortality

Construction

2.6.1 Direct mortality of amphibians could occur in three ways during construction. Firstly, through the destruction or pollution of breeding waterbodies during the breeding season (spring/early summer); secondly through the loss of terrestrial habitat adjacent to waterbodies outside the breeding period; and thirdly, between late October to early March through the destruction of hibernacula due to site clearance, top-soiling and other construction activities.

Operation

2.6.2 Amphibian mortality on roads is most obvious during breeding migrations in the early spring when hundreds of individuals may be lost on a single night within a short stretch of road (Highways Agency et al., 1993). The impact of such mortality on the wider population will vary according to a range of factors such as the proximity of the road to the breeding site, the proportion of the population that crosses the road and the volume of traffic on the road.

Habitat Loss

Construction and Operation

2.6.3 Any loss of aquatic habitat can potentially lead to a reduction of breeding habitat, possibly resulting in a localised decrease in breeding success, especially in areas that have a low pond density. In addition, the loss of pond habitats can have severe impacts on amphibian metapopulation structures by reducing the density of ponds within an area and isolating potential source populations.

2.6.4 Direct loss of certain terrestrial habitats can have implications for the ability of habitat to support substantial phases of an amphibian life cycle. However, habitat loss over 250m from a breeding pond is unlikely to have an identified effect on amphibian populations (English Nature, 2001).

2.6.5 Valuable amphibian habitat includes semi-improved grassland, scrub and woodland. Loss of these habitats would reduce available refugia, hibernation sites and feeding opportunities and lead to

exposure, predation and failure to breed. All of these effects have the potential to reduce recruitment and, ultimately, population size.

2.6.6 Alteration of natural drainage (e.g. seepage lines, burns and springs) and artificial drainage (e.g. ditches and land drains) as a result of road construction, may have an effect on amphibian populations. Water levels in breeding ponds may be critically raised or lowered such that conditions become less suitable or even unsuitable for some species (Highways Agency et al., 1993).

2.6.7 During the operational phase maintenance operations and vegetation management could result in short-term periodic terrestrial habitat loss.

Habitat Fragmentation and Isolation

Construction and Operational

2.6.8 Reduced dispersal between populations can lead to breeding ponds becoming isolated from the terrestrial habitat used by amphibians during non-breeding stages of their life cycle. In addition, the barrier effect of new roads can result in populations becoming isolated, increasing the risk of local extinction and genetic impoverishment. It is possible that amphibian populations living near major roads may be reduced in size dramatically or lost completely after 5-10 years exposure (Highways Agency et al., 1993).

Disturbance

Construction and Operation

2.6.9 Artificial lighting has been shown to affect the feeding behaviour of nocturnal frogs, reducing their visual acuity and ability to find prey (Buchan, 1993). It is reasonable to assume that the effect of light disturbance could also affect nocturnal native amphibian species. If roadside lighting at junctions illuminates areas of feeding habitat adjacent to the road then it may constitute a disturbance impact to amphibians.

Pollution

Construction

2.6.10 Accidental spills during construction could potentially contaminate breeding ponds and terrestrial habitat, resulting in a hazard to amphibians. The severity of an impact would depend on the volume and toxicity of the substance entering the water body. There is also the potential for sediment run-off to block rain seepage lines and alter the depth and size of the pond, adversely affecting resident amphibian populations.

Operation

2.6.11 Inorganic diffuse run-off from the road could pollute waterbodies, adversely affecting amphibian populations. The use of salt to de-ice roads in winter may have adverse impacts on amphibians in areas close to the road.

2.7 Terrestrial Invertebrates

Direct mortality

Construction

2.7.1 During the construction phase, earth works and heavy machinery could result in the death of slow moving, flightless, ground dwelling terrestrial invertebrates.

2.7.2 The construction phase could also result in the loss of habitats suitable for terrestrial invertebrates and, where invertebrates are present; removal will result in direct mortality.

Operation

2.7.3 The operation of infrastructure could result in an increase in direct mortality of terrestrial invertebrates through increased risk of being crushed by vehicles. Road transport has been shown to have an adverse effect upon roadside populations (Oxley & Fenton, 1976; Mader, 1984).

Habitat Loss

Construction and Operation

2.7.4 The construction of temporary features such as access roads, storage facilities and construction compounds and the footprint of operational road infrastructure will result in land-take which could result in invertebrate habitat loss. Most terrestrial invertebrates have annual life cycles and require suitable breeding conditions each year. Invertebrates are therefore more susceptible to change and are unable to survive adverse conditions which may result due to habitat loss.

2.7.5 Most terrestrial invertebrates have complex life cycles which require different habitat requirements for stages in life cycle. The requirement for several different habitats increases the sensitivity to habitat loss.

2.7.6 A number of terrestrial invertebrates require highly specialised habitat niches which may be lost through land-take.

2.7.7 Many terrestrial invertebrates have limited mechanisms of dispersal and although some species may colonise new areas, others are unable to travel any distance. Flightless species tend to inhabit those areas which are ancient, stable or isolated. When these habitats are lost through land-take, colonisation of alternative sites by flightless species is highly unlikely.

2.7.8 Terrestrial invertebrates are poikilotherms and are dependent upon external sources of heat. Warm, sunny conditions may be supplied by physical structures (walls, south facing banks, bare ground) or by vegetation. Land-take may remove these sources of heat supply.

2.7.9 In general the size of suitable habitat determines the size of invertebrate population. Land-take may reduce the size of habitat to a level where the size of the population becomes unsustainable.

Habitat Fragmentation and Isolation

Construction

2.7.10 The construction of temporary features such as access roads, storage facilities and construction compounds will result in habitat fragmentation and isolation of populations.

2.7.11 Grasslands provide suitable habitat for a range of terrestrial invertebrates especially warmth loving groups. Many invertebrates have localised populations and do not possess mechanisms for colonisation into distant areas.

Operation

2.7.12 The operation of road infrastructure will result in habitat fragmentation and isolation of populations.

2.7.13 Fragmentation of habitats is likely to occur where infrastructure severs existing areas of woodland including dead wood habitats, grasslands, and wetlands resulting in smaller, more numerous areas of habitat.

2.7.14 Large roads can act as absolute barriers to the flow of genetic material between local populations.

Changes in Hydrology

Construction

2.7.15 The construction of temporary features such as access roads, storage facilities and construction compounds could result in a change in the hydrology of habitats which are suitable for terrestrial invertebrates such as wet woodlands, marsh and waterbodies.

Operation

2.7.16 A number of terrestrial invertebrates require highly specialised habitat niches which may be lost through changes in hydrological patterns.

Disturbance

Construction

2.7.17 The construction of temporary features such as access roads, storage facilities and construction compounds could result in disturbance to terrestrial invertebrates.

2.7.18 Many terrestrial invertebrates have annual life cycles and require suitable breeding conditions each year. Disturbance during important stages of the life cycle of terrestrial invertebrates may result in a displacement of the population or a reduction in the population within the site.

Operation

2.7.19 Road infrastructure can result in an increase in disturbance of terrestrial invertebrates. Disturbance and potential loss of over-wintering sites may arise through the frequent mowing of road and junction banksides. Frequent mowing of roadside verges disturbs invertebrates, causing a potential loss of over-wintering sites. It can also lead to a loss in the structural diversity of the habitat and a reduction in species abundance and diversity (Morris, 2000).

2.7.20 Increased disturbance activities may adversely affect those species which are intolerant of habitat change. These species which are slower to adapt to these changes tend to be native and often show populations in decline (Hollifield & Dimmick, 1995; Haskell, 2000). Disturbance can benefit opportunistic species which can exploit changes to the habitat and are often non-native.

Pollution

Construction

2.7.21 The construction of temporary features such as access roads, storage facilities and construction compounds, would result in a potential increase in the exposure of terrestrial invertebrates to the risk of pollution. Pollution may affect terrestrial invertebrates in a variety of ways including desiccation through salt pollution and the bioaccumulation of heavy metals through food chains, eventually resulting in death or functional impairment.

Operation

2.7.22 Pollution sources from operational road traffic include salts, the deposition of tyre particles and products derived from petroleum combustion. During the operational phase, the periodic application of de-icing salts to the road surface may cause saline pollution from sodium chloride, magnesium chloride and calcium chloride. These salts may create an increase in ions which alter the soil pH, causing a change in plant communities and thereby affecting habitats. The ions may also cause an increase in invertebrate mortality through desiccation. The operation of the road

may result in the deposition of compounds used in vehicle components including zinc, cadmium and copper. Petroleum products are also known to contribute to levels of heavy metals causing invertebrate mortality.

Soil Compaction

Construction

2.7.23 The construction of access roads, storage facilities and construction compounds may result in soil compaction in habitats suitable for terrestrial invertebrates. Soil compaction may result in the reduction of soil porosity and suitable terrestrial niches which leads to an increase in run-off causing an increase in soil dwelling invertebrate mortality (Noss, 1995). Changes in soil porosity may also result in a change to vegetation and habitat structure.

2.8 River Habitat

Habitat Loss

Construction and Operation

2.8.1 The construction and operation of roads may result in the loss of aquatic and riparian habitat through bank modifications, road crossings and realignments. Adjacent habitat may also be lost due to the creation of temporary works, compounds and storage areas. In addition, this could lead to the loss of refuge and foraging habitat.

Habitat Fragmentation and Isolation

Construction and Operation

2.8.2 Habitat fragmentation through provision of structures, for example physical barriers such as culverts, may result in fragmentation of aquatic and riparian habitats by reducing or preventing the movement of fauna. Typically, culverts constitute long, straightened reaches of smooth substrate, devoid of in-stream or bankside habitat complexity and associated food resources. Culverts may alter channel slope and flow and the shading associated with long culverts may create a barrier between habitats either side of the culvert. The diversion of watercourses may cause habitat fragmentation by reducing channel sinuosity and potentially altering flow rates.

Pollution

Construction

2.8.3 During construction there is the risk of fuel, oil, liquid concrete, silt and other pollutants entering the watercourses. Chemicals, oils and fuels from storage tanks or leakage from plant machinery may enter watercourses through accidental spillages. Admixtures, cement and concrete may also impact watercourses through washings of plant and machinery and accidental spills. Release of sewage by damaging existing pipelines may occur during service diversions. Such pollution could reduce the habitat suitability in the watercourse and, in severe cases, may make the habitat unsuitable in the medium-term.

Operation

2.8.4 Pollutants from exhaust emissions, brake linings and catalytic converters, oils and chemicals from tyres may enter watercourses via run-off from the roads during operation. Spillages from traffic accidents may also enter watercourses in addition to suspended sediments.

Alien Species Transfer

Construction and Operation

2.8.5 The spread of invasive plants (as detailed under Terrestrial Habitats) between and within construction areas may occur. Such invasive species can shade out understorey vegetation in summer but die back in the winter, leaving bare banks vulnerable to erosion. They may also exclude native species from the riparian zone. Similarly, the spread of invasive plants during operation may occur between sediment detention basins and watercourses through maintenance activities (such as dredging).

Changes in Hydrology

Construction

2.8.6 The dewatering of watercourse channel sections will temporarily alter the normal flow patterns in each watercourse, potentially leaving some areas of habitat without any water present. The presence of construction site compounds may increase surface water run-off and decrease percolation to groundwater.

Operation

2.8.7 New roads may alter the slope of the surrounding land and/or may increase the amount of impermeable surface, potentially resulting in an increase in the total discharge via run-off to the watercourses. Bridges, culverts and embankments may also result in changes to the flow in terms of velocity and flood storage capacity. Altered flow regime may result in bed and bank instability or sedimentation, thereby altering the spread of habitat suitability within the watercourse.

2.9 Aquatic Macroinvertebrates

Direct Mortality

Construction Only

2.9.1 The dewatering of channels to enable the realignment of watercourses and permit the installation of culverts or bridges could remove invertebrates from the substrate and watercourse. The length of watercourse affected will be equivalent to that directly affected by dewatering and will continue for the period until water is once again permitted to flow through the new alignment and culvert structure.

Habitat Loss

Construction and Operation

2.9.2 The dewatering of areas where watercourses will be realigned or where culverts or bridges are to be incorporated will remove habitat suitable for aquatic macroinvertebrates for the period of construction. The habitat present in areas where culverts are proposed would become permanently unsuitable for aquatic macroinvertebrates. Habitat in areas where realignment has occurred may not recover to pre-construction condition, although a certain level of natural substrate re-colonisation may reverse this trend.

Habitat Fragmentation and Isolation

Construction

2.9.3 The dewatering of areas where watercourses will be realigned or where culverts or bridges are to be incorporated could prevent the natural local migration of macroinvertebrates. Intrusion into the

watercourse channel and the sections of watercourses to be dewatered could constitute a loss of habitat for aquatic macroinvertebrates. The isolated sections of watercourse could be unavailable to surrounding communities during the construction period.

Operation

2.9.4 The insertion of culverts within watercourses could hinder or even prevent the natural local migration of macroinvertebrates. The isolated sections of watercourse either side of the culvert could be unavailable to surrounding communities, with the exception of the limited downstream transport of invertebrates in high flow periods.

Pollution and Sedimentation

Construction

2.9.5 Site compounds and in-channel works have the potential to discharge pollutants and surface sediment which could lead to the release of excess sediments into the watercourse. This may lead to the smothering of substrate, most notably gravel and riffle areas which in turn could result in the suffocation of invertebrates within the substrate and water column in addition to the deterioration of habitat.

Operation

2.9.6 Surface run-off from the operational road has the potential to discharge pollutants and excessive quantities of suspended sediment into nearby watercourses. Pollutants can arise from road traffic accidents and from gradual accumulation of pollution from road traffic. The release of sediments from the road surface to the watercourse could lead to the smothering of substrate, most notably gravel and riffle areas, which could lead to the suffocation of invertebrates within the substrate and water column as well as the deterioration of flow features and habitat in the medium-term.

Changes to Hydrology

Construction

2.9.7 The construction of culverts and bridges, as well as any associated watercourse realignments, will require the dewatering and potentially the re-direction of river channel or channel sections. This has the potential to alter flow patterns in the vicinity of the structure for the period of construction. This could alter habitat complexity for aquatic macroinvertebrates and may reduce the suitability of habitat for more sensitive species.

Operation

2.9.8 During operation, structures such as culverts and bridge footings/foundations, as well as any associated watercourse realignments, have the potential to alter flow patterns in the vicinity of these structures. This could alter habitat complexity for aquatic macroinvertebrates and may reduce the suitability of habitat for more sensitive species.

Shading

Operation Only

2.9.9 The presence of new and extended culverts would lead to an increase in shading of the channel, which would reduce the habitat available for macrophyte growth and have a negative impact on the in-channel habitat available for invertebrates.

2.10 Freshwater Macrophytes

Direct Mortality

Construction only

2.10.1 The construction of culverts and areas exposed to dewatering and realignment are likely to involve the removal of native plant species from within the wet channel and margins. This would potentially remove key plant species and risk compromising the resilience of the resident macrophyte community.

Habitat Loss

Construction and Operation

2.10.2 The construction of culverts and bridges and the dewatering of sections to be realigned, together with temporary features such as access roads, storage facilities and construction compounds, could result in habitat loss through removal of habitats suitable for freshwater macrophytes. This may result an overall decline of some species of macrophyte, in turn impacting on other species that use macrophytes for cover and food. Some macrophyte species may be able to recolonise in other areas but others could be unsuccessful, which would be likely to result in an overall decline in habitat quality. Bridges and culverts may result in increased shading of the channel, resulting in reduced macrophyte growth or destruction of shade intolerant species. Some species may be unable to recolonise to other suitable habitats resulting in a population decline.

Pollution

Construction

2.10.3 During construction there may be an increased risk of pollution to watercourses and waterbodies and in turn to the macrophyte communities present. Pollution sources that could impact upon habitat and water quality for aquatic macrophyte growth include vehicle fuels, sewage and chemicals, which could impact upon freshwater macrophytes in a variety of ways including desiccation through salt pollution and reduced water quality through sewage (nutrients) and chemical ingress. Potentially, an increasing sediment load within the watercourses could develop throughout the construction phase.

Operation

2.10.4 Road operation may result in a potential increase in the exposure of freshwater macrophytes to the risk of pollution and sedimentation through run-off, accidental spillages and road traffic accidents. Pollution sources from road traffic include salts, the deposition of tyre particles and products derived from petroleum combustion.

Changes in Hydrology

Construction

2.10.5 Construction of temporary features such as access roads, storage facilities and construction compounds may result in a change to the hydrological regime of watercourses, resulting in potential impacts to the plant communities present. Alteration of land surfaces may result in increased/decreased run-off into watercourses and waterbodies and construction of in-stream culverts, bridge footings or the realignment of channels may alter in-stream flows, thereby altering the pattern of suitable habitats within the watercourse. Macrophyte species that are adapted to specific conditions may be particularly susceptible to changes in hydrology.

Operation

2.10.6 Hydrological changes from new topographic profiles of culvert bases, bridge footings or the realignment of channels and increased or decreased run-off from surrounding land could result in a change of flow patterns. Altered flow patterns could impact on habitats available for freshwater macrophytes. Wet habitats may be reduced in size or lost completely, and new drier habitats may be formed, resulting in a change in the macrophyte communities present. Where hydrological changes result in higher flows in-channel, an increased risk of flooding or alterations in the pattern of scour and deposition, then the impact may extend further downstream that just the area around the structure.

Shading

Operation

2.10.7 The presence of new and extended culverts would lead to an increase in shading of the channel, which would reduce the habitat available for macrophyte growth.

2.11 Freshwater Fish

Direct Mortality

Construction Only

2.11.1 Fish and egg mortalities may occur from the construction of bridges and culverts at crossing points through the mechanical removal of the river bed and/or dewatering of sections of the river.

Habitat Loss

Construction Only

2.11.2 Dewatering lengths of watercourse for the installation of culverts/bridges at crossing points could result in habitat loss and reduction of habitat diversity.

Habitat Fragmentation and Isolation

Construction

2.11.3 Dewatering of sections of running water during construction could result in habitat fragmentation, resulting in fish being unable to migrate up or down a river. Watercourse diversion may cause habitat fragmentation by reducing channel sinuosity and potentially altering flow rates. Physical barriers such as the dewatered sections may prevent fish migration. The prevention of fish migration may lead to a reduction in access to suitable feeding, breeding and nursery habitat, potentially affecting annual recruitment to the population.

Operation

2.11.4 Physical barriers, such as long culverts, with homogenous substrate, no in-stream or bankside cover or a step change in gradient could result in fragmentation of aquatic habitats by reducing or preventing the movement of fish. The diversion of running water during construction through pipes or simple and straight temporary channels may cause habitat fragmentation by creating either a physical barrier (in the case of pumps and pipework) or reducing the availability of habitat within the temporary channel that would enable the safe passage of fish. The prevention of fish migration may lead to a reduction in access to suitable feeding, breeding and nursery sites, potentially affecting annual recruitment to the population.

Disturbance

Construction Only

2.11.5 Noise and vibration during construction, earthworks and culvert/bridge construction may disturb resident fish, damage eggs and young larvae of fish species sensitive to noise and vibration (such as salmonid fish) and may form a behavioural barrier to migratory fish.

Pollution and Sedimentation

Construction

2.11.6 During construction of new roads and associated infrastructure there could be an increased risk of pollution to watercourses. Chemicals, oils and fuels from storage tanks or leakage from plant machinery may enter watercourses through accidental spillages. Admixtures, cement and concrete may also impact watercourses through washings of plant and machinery and accidental spills. Release of sewage by damaging existing pipelines may occur during service diversions.

2.11.7 Vegetation clearance and the creation of construction compounds could expose the area to surface water run-off which could lead to the release of excess sediment into the watercourse. This could settle in substrate gravels, thereby altering or decreasing habitat suitability and preventing successful spawning and egg development. Re-suspension of anoxic sediments during the construction of roads and associated infrastructures may also occur.

2.11.8 Fish species show varying tolerances to suspended solid content and the effect will depend upon the elevation of suspended sediment concentration in relation to normal conditions in the watercourse as well as the period over which fish are exposed to elevated levels.

2.11.9 Re-suspension of anoxic sediments could also result in the reduction of dissolved oxygen (DO) concentrations. Low DO levels in particular may quickly have a direct impact on fish, especially salmon, and may lead to the avoidance of hypoxic areas, thereby reducing available habitat area and may reduce feeding and growth rates (Turnpenny et al., 2004). Reduction in DO concentrations due to anoxic sediment disturbance is likely to last only until new river bed equilibrium is reached.

Operation

2.11.10 A variety of polluting effects may result from road run-off (surface water drainage from roads and other hard standings). Surface water could also carry any material deposited, accidentally or otherwise, onto the road or hard standing. Absence or non-function of drainage systems, particularly after periods of heavy rain, may result in surface water directly entering the watercourse. The increase in solid surfaces could increase the extent of surface water run-off which could lead to the release of excess sediment into the watercourse. This could settle in substrate gravels, thereby altering or decreasing habitat suitability and preventing successful spawning and egg development.

2.11.11 Aquatic organisms are particularly sensitive to soluble inorganic pollution and mortality of both fish and invertebrates may be caused by consistent exposure to quite low levels of soluble metal salts, notably those of cadmium, lead, copper and zinc. Maximum levels for copper and zinc are laid down in the Environmental Quality Standards (EQS). Insoluble inorganic compounds are generally associated with sediments and may be re-mobilised by construction activity.

2.11.12 The organic constituents of run-off may include vehicle fuel and oil, herbicides and pesticides and various other hydrocarbons. Immiscible fuel and oil may present a direct threat of mortality to fish by smothering gill structures. Sub-lethal effects may also result from organic pollution with various physiological changes having been noted, dependent on the particular compound(s) involved. Indirect effects such as mortality of invertebrate populations may also affect fish populations.

Artificial Lighting

Construction and Operation

2.11.13 Artificial light may alter the behaviour of migratory fish. Artificial light from the road and/or construction compound directed onto the water surface during either phase of the proposed scheme could disrupt migration of sensitive species. Light may also affect the behaviour of resident species when undergoing location feeding and/or spawning migration within the watercourse.

Shading

Operation

2.11.14 The presence of new and extended culverts would lead to an increase in shading of the channel that, for fish, could lead to greater provision of cover and protection within the channel and may have a positive impact.

3. Generic Mitigation

3.1.1 Current guidelines highlight the importance of an agreed approach to mitigation prior to publication of the ES, for example Institute of Ecology and Environmental Management (IEEM) guidelines for Ecological Impact Assessment (IEEM, 2006) states that 'an EcIA is effectively meaningless if it provides an assessment of the significance of the residual impacts of a scheme based on the proposed mitigation measures being implemented even though these measures have not been agreed by the developer'. This statement is supported by the Design Manual for Roads and Bridges (DMRB) (Highways Agency et al., 1993) which states that the 'aims and objectives of the mitigation and any post construction monitoring should be agreed before the mitigation design process starts'.

3.1.2 The development of mitigation measures to address the potential impacts associated with construction and operation of the proposed scheme were developed through a series of discussions and workshops with Transport Scotland and through consultation with SNH and SEPA. Mitigation measures listed in this ES will be specified in the contract documents to ensure implementation (Chapter 1, Introduction, provides more information on scheme procurement).

3.1.3 Selected legislation and guidance underpinning the requirement for mitigation is provided in Table 3.1. Table 3.2 describes the proposed generic mitigation measures.

3.1.4 Table 4.1 presents a summary of potential impacts considered by the specific impact assessment which are expressed as significant, not significant or not applicable. Only those impacts assessed to be significant are considered in the subsequent specific impact assessment.

3.1.5 Where the proposed scheme results in significant ecological impacts that cannot be sufficiently mitigated by generic measures (as outlined in Section 3), for example, the loss of woodland, wetland and other ecologically important habitats, specific mitigation measures such as habitat creation at specific locations will be implemented to offset these impacts.

3.1.6 It should be noted that elements of the mitigation strategy such as habitat creation, fencing and underpasses have been strategically designed to provide mitigation for numerous receptors simultaneously, for example, badgers and otters will use the same underpasses, and bats will utilise underpasses, culverts and overbridges if designed and managed through careful control of lighting and planting.

3.1.7 Tables 4.2 - 4.25 below describes the specific impacts, proposed mitigation and residual impacts pertinent to each ecological receptor.

Table 3.1: Selected Relevant Extracts from Legislation/Guidance Underpinning the Requirement for Mitigation

Mitigation Legislation/Guidance Extracts
Environmental Impact Assessment (Scotland) Regulations 1999, Schedule 4, Part 1 http://www.opsi.gov.uk/legislation/scotland/ssi1999/99900107.htm#sch3 Schedule 4: Information for inclusion in environmental statements, Part 1 requires "A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment" to be provided.
Nature Conservation (Scotland) Act 2004, Part 1, Section 1.1: http://www.opsi.gov.uk/legislation/scotland/acts2004/asp_20040006_en_1 "It is the duty of every public body and office-holder, in exercising any functions, to further the conservation of biodiversity so far as is consistent with the proper exercise of those functions."
NPPG 14 Natural Heritage, Paragraph 74: http://www.scotland.gov.uk/Publications/1999/01/nppg14 "74. Planning authorities should have full regard to natural heritage considerations in determining individual applications and contributing to the implementation of specific projects. While in some circumstances it will be necessary to refuse planning permission on natural heritage grounds, authorities should always consider whether environmental concerns could be adequately addressed by modifying the development proposal or attaching appropriate planning conditions. In negotiating over development proposals, authorities should first seek to avoid any adverse effects on the natural heritage. Where this is not possible and other material considerations clearly outweigh any potential damage to the natural heritage, they should endeavour to minimise and mitigate the adverse effects and consider the scope for compensating measures. They should always encourage the retention and enhancement of features of natural heritage interest and seek to avoid the fragmentation or isolation of habitats. Where appropriate, they should also consider the scope for concluding an access agreement".
Design Manual for Roads and Bridges 2001, Volume 10, Section 4, Chapter 3.3: http://www.standardsforhighways.co.uk/dmrb/vol10/section4/ha8401.pdf "Avoiding the negative effects of the project should be the first intention of any project. Mitigation should be provided where this is not possible. Mitigation design should be provided on a site-by-site basis, taking account of appropriate survey information. Land taken or disturbed by project works should be minimised, except where there is a need to acquire more extensive areas of land for environmental mitigation. Where practicable, and within the powers and resources of the Overseeing Organisation, opportunities for habitat creation or enhancement and species protection should be taken in addition to providing mitigation. Timing of activities should avoid impacts on protected and rare species and habitats wherever possible. Mitigation design should retain, or wherever possible create, natural habitat links which may act to assist wildlife movements. Special engineering features (e.g. tunnels, ledges, and bridges) combined with fencing where appropriate, can be used to assist in maintaining links across roads".
Scottish Transport Appraisal Guidance (STAG). Environment Section - Paragraph 7.4.6: http://www.transportscotland.gov.uk/files/STAG_Technical_Database_Section_7_May_2008.pdf "7.4.6 The overall objective should be to maintain biodiversity in the study area, including wildlife habitats and species and to improve the status of rare and vulnerable species wherever possible. Transport proposals should therefore be designed: • To avoid harmful development affecting protected habitats. All EU member countries have such areas and networks, for example, those established under the Birds Directive (79/409/EEC) and the Habitats Directive (92/43/EEC) — the Natura 2000 sites, National Nature Reserves, Sites of Special Scientific Interest and regionally and locally designated sites; • To avoid development in, or close to, unprotected but valuable and sensitive habitats (e.g. important bird areas); • To avoid fragmentation of wildlife migration routes, e.g. by avoiding migration zones, or by mitigating the barrier effect by providing a tunnel or ecoduct' for wildlife; and • To adopt the "no net effect" principle, providing full compensation for lost biodiversity values where loss is unavoidable. "
WebTAG - Biodiversity Sub-objective. TAG Unit 3.3.10. http://www.webtag.org.uk/webdocuments/3_Expert/3_Environment_Objective/3.3.10.htm 1.2.18 Mitigation. Where scheme options include proposals for mitigation, this should generally be taken account of in the appraisal of impacts. However, an exception to this general rule is described below. There are three categories to consider: Design proposals to minimise the impact of the proposal on the site (reducing run-off, for example); On-site, or near-site, mitigation to help conserve existing biodiversity interest where the impacts can not be minimised (e.g. dedicated animal crossings, land management regimes); and Off-site proposals (such as habitat replacement) to compensate for biodiversity and earth heritage losses. These categories should be developed sequentially in scheme design. 1.2.19 The first two categories are essentially about minimising the effects on or near the site. It is appropriate for these to be considered in appraising impact, provided they have been documented properly in the Environmental Statement. The key is to make an appropriate judgement about net impact. Where there is some risk in the mitigation proposals, it

Mitigation Legislation/Guidance Extracts
is appropriate to complete separate appraisals, for the 'with' and 'without' mitigation cases. 1.2.20 The third category above is about compensation for expected loss, though in Environmental Statements it is often described as 'mitigation'. A precautionary approach needs to be taken here: often it is not appropriate to lower the impact category on the basis of off-site compensation proposals, as these are unlikely to fully recompense for the lost features. This is especially so for the more valuable sites.
SNH (2005) - A Handbook on Environmental Impact Assessment, Technical Appendix 2, Paragraph 28-30 'One of the main aims of Environmental Assessment is to avoid significant adverse effects. However, if a proposal is to go ahead, it will not always be possible to avoid effects, although there will usually be opportunities to reduce or minimise adverse impacts by the use of mitigating measures, such as: • locating project elements to reduce adverse effects; • using construction and operation methods which reduce adverse effects, e.g. to avoid disturbance at critical times of the year; and • introducing specific measures into project design, that will reduce adverse effects, e.g. including silt traps in new drains to control pollution from surface water run-off.'

Table 3.2: Generic Mitigation Measures

Project Phase	Mitigation Type	Impact	Description of Generic Mitigation
Construction	Prevent/reduce	Direct Mortality	• Pre-construction surveys for badger setts, otter resting places and bat roosts adjacent to the proposed scheme plus a 50m buffer will be undertaken and their locations communicated to construction staff in strict confidence to ensure no direct mortality during site clearance. • Where loss is unavoidable, destruction of otter resting places and bats roosts will only take place under the conditions of a European Protected Species (EPS) licence from the Scottish Government through consultation with SNH. • Destruction of badger setts will only take place under the conditions of a SNH badger development licence. • Destructive searches of terrestrial habitat will be undertaken prior to site clearance making the habitat unsuitable for amphibians. Searches will be carried out between March and October when amphibians are active and out of hibernation. Amphibians captured during this procedure should be relocated to pre-identified areas that are sheltered and close to a suitable refuge or pond, in weather conditions conducive to activity. The location of pre-identified areas will be established through consultation with SNH. • Site clearance of vegetation will be undertaken outside of the main bird breeding season where possible (typically March - July inclusive). Where site clearance works must be undertaken during the main bird breeding season, methods of exclusion and deterrent will be used to prevent birds beginning to nest in suitable areas. The precise methods of deterrent will be developed according to habitat types and the species concerned as part of the habitat management plan through consultation with SNH. • Any clearance works undertaken during February or August are also at moderate risk of affecting breeding birds: an Ecological Clerk of Works (ECoW) will therefore be used to check any areas for evidence of breeding birds prior to works commencing. • Site clearance works undertaken from September - January inclusive will not be subject to any specific mitigation for breeding birds, however, the Ecological Clerk of Works would advise all contractor staff of the residual risk of birds nesting outside of the main bird breeding season and a requirement to stop work should they be encountered. • All cleared material is to be rendered unsuitable for nesting birds. • Tree felling will be carried out by experienced contractors according to agreed felling methods and any licensing conditions to reduce direct mortality of bats through loss of roosts. Such methods may include allowing dispersal times, exclusion of roosts, soft felling techniques, or retention of roost features in newly created areas. • All pits will be kept covered at night or mammal ladders will be provided for escape. • Crossing points will be designed in accordance with DMRB recommendations (Volume 10) in such a way that animals can use them for safely crossing the proposed scheme. In particular, underpasses will be provided at commuting corridors between badger setts and foraging grounds, and where applicable bridges, culverts and underpasses will be provided where otter paths and water courses cross the proposed scheme. • Temporary mammal-resistant fencing is to be provided around construction compounds following a specification agreed through consultation with SNH. Where required, permanent mammal fencing will be erected in accordance with DMRB and SNH guidance (Highways Agency et al., 1993; Scottish Natural Heritage, Undated). Associated planting will be placed in such a way that animals will be directed towards safe passing places. Where the operational scheme crosses watercourses otter-proof fencing will be installed 150m either side. • Mammal ledges will be installed in culverts where there is no current provision and will comprise the installation of a ledge of minimum 500mm wide with access to the banks via ramps. Ledges must be a minimum of 150mm above high water levels and allow 600mm headroom. Ledges must take into account the preferred bank used by otters, and should take into account other features including weirs. • Drainage systems are to be designed so as to prevent otter entering and becoming trapped. • Linear features are to be retained as far as practicable allowing safe crossings for bats as advised by the ECoW. Where this is not possible, sensitive planting and the provision of bridges and culverts adapted to make them suitable for use by bats will be used to prevent bats flying

Project Phase	Mitigation Type	Impact	Description of Generic Mitigation
			directly onto the road (e.g. Bach & Limpens, 2004). • The extent of areas affected by culverts, watercourse realignment and dewatering will be minimise as far as practicable. • Best practice guidance to be adhered to when working within salmonid watercourses. • Reasonable precautions are to be undertaken to avoid/reduce in-channel works and translocation of channel substrate. • Remove and relocate fish from channels to be dewatered for construction of culverts, realignments or bridges. • Plant and personnel may be constrained to a prescribed working corridor through the use of temporary barriers, thereby minimising damage to habitats and potential direct mortality and disturbance to animals located within and adjacent to the proposed scheme working corridor.
Operation	Prevent/reduce	Direct Mortality	• Habitat management of areas of woodland, scrub and/or grassland should be undertaken outside the main bird breeding season (March - July inclusive) to ensure that breeding birds, their eggs and/or nestlings are not subject to direct mortality. • Any maintenance works required during the breeding bird season should be subject to the same restriction outlined under construction. • Maintain mammal proof fencing. • Crossing points for bats will be monitored as part of the operational aftercare management contract to assess whether additional provision is required.
Construction	Prevent/reduce	Habitat Loss	• Habitat loss will be reduced by restricting felling and vegetation clearance activities to the minimum area necessary for the works. • Minimise areas of vegetation clearance and demarcate clearly with fencing and signs, areas of retained vegetation and retained dead wood habitat. • Areas of woodland, wetland and scrub will be avoided, where possible, to prevent degradation of valuable habitat. • Piles of brash and smaller material will be placed in tightly packed, large litter piles in a range of aspects. • Where the removal of dead standing, fallen and felled timber is necessary, the material will be relocated into areas of existing and newly created woodland habitat, or adjacent habitats. Relocated deadwood will be placed in areas of partial shade. • Where loss or degradation of valuable habitat is unavoidable and where watercourses are realigned, they will be returned, where possible, to their former quality or improved once construction is complete. • Landscape planting and newly created habitat will be comprised of predominantly native species of local provenance where available, and will comprise a mixture of species. • Where loss or degradation of valuable habitat is unavoidable and where watercourses are realigned, they will be returned, where possible, to their former quality or improved once construction is complete. • Sowing/planting should be undertaken as soon as possible following completion of the works to reduce the likelihood of the areas being colonised by invasive, non-native species which are of lower value to wildlife. • All areas of habitat loss due to temporary works, site compounds, easements, working areas or access roads will be reinstated following construction on a like for like basis. • Earth should not be moved from one site to another to avoid cross-contamination. • The loss of roosts and roosting opportunities will be offset by the provision of replacement roost habitat (see direct mortality). Bat surveys will determine the species, seasonal and dimensional requirements of replacement roost habitat. • Pre-construction surveys to identify otter resting places adjacent to the proposed scheme plus a 50m buffer will be undertaken and the locations of holts, couches and hovers will be communicated in strict confidence to construction staff. Where loss of a resting place is unavoidable, an EPS licence must be obtained from the Scottish Government through consultation with SNH.

Project Phase	Mitigation Type	Impact	Description of Generic Mitigation
			• On a case by case basis, setts and otter resting places lost to construction may require replacement. Any artificial setts and otter resting places will be created in line with best practice guidance and with consultation with SNH. • Habitat creation is to contribute to biodiversity targets identified in local (LBAP) and national (UKBAP) strategies, for example, localised woodland planting will be designed to improve landscape connectivity for UK and LBAP bird species. • Offsetting the loss of ecologically important habitats will occur through habitat creation schemes including roadside planting, where appropriate, and will be integrated with landscape planting as per Chapter 12 (Landscape).
Operation	Prevent/reduce	Habitat Loss	• Operational maintenance of areas of woodland, scrub and/or grassland is minimised as far as practicable. • During the operation of the proposed scheme, management and maintenance of roadside verges will be undertaken to maintain and enhance floral diversity. • Appropriate management of existing boundary habitats such as hedgerows or rough edges for the benefit of key farmland species of conservation concern such as yellowhammer (*Emberiza citronella*), skylark (*Alauda arvensis*), linnet (*Carduelis cannabina*), meadow pipit (*Anthus pratensis*) and grey partridge (*Perdix perdix*). • Replacement roosts will be monitored during the aftercare and operation phase of the road in order to identify further roost requirements.
Construction	Prevent/reduce	Habitat Fragmentation	• Where practicable, connectivity between areas of bat foraging and roosting habitat will be retained during the construction of the proposed scheme. • Construction work at watercourses will be undertaken in such a way that animals will be able to move along the bank throughout the works period. This may require ensuring culverts are open at night to avoid disrupting animal movements and prevent severance of home ranges and fragmentation of foraging and lying up resources. Where necessary, ledges and underpasses will be provided so animal commuting routes are retained throughout construction and one side of rivers being bridged must remain intact for as long as possible to provide safe access. • Where practicable, the creation of crossing points; underpasses for mammals, provision of mammal ledges and the provision of high span bridges will be provided where the road severs significant commuting routes for species including badger, otter and bats. Best practice guidance provided by a number of sources (Bach & Limpens, 2004; Brinkmann et al., 2003; Limpens et al., 2005: bat guidance for example) includes the design of culverts and tunnels of suitable dimensions, preferably allowing water to flow through. The provision of lead-in structures or planting will additionally increase the likelihood of crossing points being used. • Where planting is recommended specifically to provide continuity of habitat for bats, temporary fencing will be provided to maintain flight lines and provide shelter until trees have matured in accordance with DMRB (Highways Agency et al., 1993). • Watercourse realignments, if designed sustainably are favourable over culverting and could lead to positive impacts in poor quality streams through channel and riparian enhancement work. They will also be designed to minimise the length requiring realignment to reduce habitat fragmentation. The exception to this is where realignment can be used to improve habitat complexity and quality. Realignments in low gradient areas should be designed to minimise sedimentation and in high gradient areas to minimise erosion. The opportunity to create and enhance habitat should be incorporated through the inclusion of meander bends, secondary channels and riparian zones, where appropriate. • Where bridging is not feasible and culverts are required, their length should be kept to a practical minimum. Where practicable, the insertion of each culvert will not alter the gradients markedly from existing conditions so as to avoid altering flow patterns and resulting habitat loss and to avoid excessive siltation or erosion. • Culverts should be appropriately maintained to ensure continual operation of the asset during construction. Blocked or poorly screened culverts may impede the natural migration of individuals or lead to greater fragmentation of habitats. Culverts should remain unobstructed at night.

Project Phase	Mitigation Type	Impact	Description of Generic Mitigation
			• Altered flow regimes resulting from the use of culvert extensions or channel realignments should be avoided. Culverts should be oversized to allow natural bed and bank profiles to remain, where practicable, and should thus help to reduce the risk of erosion through increased velocities and heightened flood risk. • On sites where dewatering is anticipated, the creation of a temporary diversion channel with suitable sized replacement substrate or transplanted substrate from the section being dewatered will be undertaken, making sure that the size and flow in the diversion channel is as near to the existing channel as possible.
Operation	Prevent/reduce	Habitat Fragmentation	• Where practicable, operational management should not compromise the connectivity between areas of bat foraging and roosting habitat. • Roadside verges and areas of habitat restoration will be managed to maintain and enhance the ecological value of the habitats and to improve the linkages between similar habitats along the route corridor. • Habitat connectivity will be enhanced through the reinstatement of appropriate linear features such as dry stone walls and hedgerows along the boundary of the proposed scheme. Where riparian habitats are severed, compensatory measures will include enhancement of the habitats, where possible. Fencing and planting of the riparian areas will create important habitat, enhance the connectivity of habitats within the wider landscape and will also protect the stream banks from erosion and poaching from livestock. • Severance of habitats will be offset by provision of alternative habitat. Where possible habitat creation should aim to fill in existing gaps in linear vegetation features, adjoin or connect existing blocks of woodland or act as stepping stones between habitat areas (Entwistle et al., 2001). • The provision of planting on verges and embankments will provide new linear features along which bats can navigate, and will also reduce the risk of bats flying directly onto the road. • Severance and fragmentation of otter habitat will be prevented during operation by retention of commuting routes so movement between areas of habitat can be maintained. This will be achieved by installing mammal ledges, fencing and underpasses and by habitat maintenance as detailed for habitat loss above. • Culverts should be appropriately maintained to ensure continual operation of the asset during operation. Blocked or poorly screened culverts may impede the natural migration of individuals or lead to greater fragmentation of habitats.
Construction	Prevent/reduce	Disturbance	• Where practicable works compounds, storage sites, access roads and construction work will be located/carried out at least 30m away from bat roosts and sensitive habitats for birds, and at agreed minimum distances from sensitive habitats for otter and badger as advised by the ECoW. Any works to be undertaken within this distance must be subject to consultation with SNH, and undertaken under licence where applicable on a case by case basis. • The use of construction lighting will control the potential for light spillage outwith the boundary of construction sites and site compounds according to BS 5489 requirements and following guidance on lighting (e.g. Bat Conservation Trust and Institute of Lighting Engineers, 2007) including the use of directional lighting or preventative measures (e.g. installation of shields, hoods or limiting the height of lighting columns). Where night works are required, directional lighting is to be used to ensure that bat roosts, woodland edges, foraging areas and waterbodies (to reduce disturbance to migratory fish and otters) are not disturbed, with any exceptions to be agreed with the ECoW. Curfew times will be established on a case by case basis to ensure that disturbance to sensitive species is avoided or reduced. Monitoring and compliance of potential adverse impacts arising from light spillage will be undertaken/determined by the ECoW. If adverse impacts are identified, appropriate additional preventative measures will be undertaken. • Where practicable, night-time working (that undertaken between sunset and sunrise) is to be avoided. Where night-time working is unavoidable mitigation is to be agreed with the ECoW. • Screens such as bunds and barriers will be provided along the proposed scheme to offset disturbance caused by noise and vibration. • Alternative roosts for bats, in the form of bat boxes, will be provided where disturbance is likely to be unavoidable during construction.

Project Phase	Mitigation Type	Impact	Description of Generic Mitigation
			• Construction activities such as blasting, piling, grouting or any other activity likely to result in significant disturbance to breeding birds must (as far as practicable) be undertaken outside the main bird breeding season (March - July inclusive). Where it is not possible to time works outside the breeding season, consideration should be given to avoiding works near habitats identified by the ECoW as being of high value or high sensitivity for breeding birds. • In-channel works and piling will avoid the salmonid and lamprey spawning and salmonid egg incubation periods (October - May inclusive). • A method statement will be prepared in advance for all areas where tree and scrub removal is required. An ECoW will monitor vegetation removal and associated activities.
Operation	Prevent/reduce	Disturbance	• The design of operational lighting will control the potential for light spillage outwith the boundary of the proposed scheme in according to BS 5489 requirements and following guidance on lighting (e.g. Bat Conservation Trust and Institute of Lighting Engineers, 2007) including the use of directional lighting or preventative measures (e.g. installation of shields or hoods). Lighting will be directed away from badger setts, bat roosts, woodland edges, foraging areas and waterbodies to avoid or reduce disturbance to migratory fish and otters as identified by the ECoW. • Alternative bat roosts will be provided where disturbance is likely to be unavoidable during operation. • Soft-start techniques are to be applied to piling work procedures to encourage sensitive species to evacuate the area. • Barriers and screens, such as noise barriers, will be provided to protect bat roosts (identified in pre-works surveys) from direct disturbance from noise, lighting and vibration. • Maintenance of areas of woodland, scrub and/or grassland will be minimised as far as practicable. • Creation of replacement holts as described in the habitat loss section above will offset the loss of existing resting habitat due to disturbance as a result of the operational scheme
Construction	Prevent/reduce	Pollution	• Site management practices to avoid or reduce the risks of secondary impacts on habitat adjacent to the proposed scheme will be adopted. • Surface and foul water will be appropriately drained and stored. These control measures must be in place before earthworks commence. • Chemicals, oils and fuels will be kept safely stored and away from water features and waste will be appropriately managed. • Plant and machinery must not be fuelled in the vicinity of watercourses. • Sites will be restored fully on completion of works and contractors will adhere to below, with respect to preventing pollution incidents near watercourses and water features. • The contractor will be required to abide by SEPA PPG 1, 3, 5, 6, and 21. • Emergency procedures and spillage kits must be available and construction staff must be familiar with emergency procedures. • Road run-off will be treated using Sustainable Drainage Systems (SUDS) techniques including collection in treatment facilities including petrol interceptors, silt traps and balancing ponds according to SEPA PPG guidelines as detailed above (SEPA, February 2003). • Vehicles must be prevented from fording watercourses by the provision of temporary culverts/bridges. • Silt traps must be placed beside all temporary watercourse crossings and maintained and cleaned regularly. • Vegetation buffer strips are to be maintained where practicable. • Levels of dust will be managed so that this does not build up significantly on trees and scrub vegetation. Measures to avoid or reduce air pollution impacts will be implemented and will include measures such as: dampening down construction areas and material stockpiles, especially when weather conditions are dry and windy; use of cutting equipment, e.g. abrasive disc cutters, that utilise water dust suppression; significant material stockpiles to be enclosed as far as practicable; concrete batching to be carried out only in enclosed or shielded areas; setting and enforcing appropriate speed limits on haul roads; implementing regular dampening down of unsurfaced site and access roads using water bowsers, particularly during dry, windy conditions; and provision of wheel washing facilities at site exits.

Project Phase	Mitigation Type	Impact	Description of Generic Mitigation
Operation	Prevent/reduce	Pollution	• Road run-off will be treated using SUDS techniques including collection in treatment facilities including petrol interceptors, silt traps and balancing ponds according to SEPA PPG guidelines as detailed above under Construction (SEPA, February 2003). • Drainage systems must be grilled to prevent otter entering and becoming trapped. • Vegetation buffer strips are to be maintained where practicable.
Construction	Prevent/reduce	Alien Species Transfer	• Surveys will be undertaken pre- and post-construction to confirm the detailed location of any alien species. • An invasive weed management strategy is to be developed prior to the start of construction. • Any alien species within the land-take must be clearly marked and soil from this area will have to be treated to ensure there is no transfer. • Best practice (via method statements) will be ensured to avoid intra/inter-site transfer of alien species.

4. Specific Impacts, Mitigation and Residual Impacts

Table: 4.1: Receptors and features and list of impacts/activities assessed. (Key: ○ = not significant, ● = significant impact (before mitigation), n/a = not applicable).

Receptor	Feature	Impact/activity									
		Direct Mortality	Habitat Loss	Habitat Fragmentation	Disturbance	Pollution/ Sedimentation	Air Quality (NOx and Nitrogen Deposition)	Alien Species Transfer	Changes in Hydrology	Provision of Structures	Soil Compaction
Terrestrial habitats - construction	St. Margaret's Marsh SSSI	n/a	○	○	○	●	n/a	●	○	○	n/a
	Woodland	n/a	●	●	○	○	n/a	●	○	○	n/a
	Ferry Hills SSSI	n/a	○	○	○	○	n/a	○	○	○	n/a
	Waterbodies	n/a	○	○	●	○	n/a	○	○	○	n/a
	Species-rich grassland	n/a	○	○	●	○	n/a	●	○	○	n/a
Terrestrial habitats - operation	St. Margaret's Marsh SSSI	n/a	●	○	○	○	○	○	●	○	n/a
	Woodland	n/a	●	●	○	●	n/a	○	○	○	n/a
	Ferry Hills SSSI	n/a	○	○	○	○	○	○	●	○	n/a
	Waterbodies	n/a	●	○	○	●	n/a	○	○	○	n/a
	Species-rich Grassland	n/a	●	○	○	○	n/a	○	○	○	n/a
	Firth of Forth SSSI	n/a	See Chapter 11 (Estuarine Ecology)				○	n/a	n/a	Chapter 11 (Estuarine Ecology)	n/a
Badger - construction	Social Group A	●	○	○	●	●	n/a	n/a	n/a	n/a	n/a
	Social Group B	●	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Population C	●	○	○	●	●	n/a	n/a	n/a	n/a	n/a
	Social Group D	●	○	○	○	●	n/a	n/a	n/a	n/a	n/a
	Social Group E	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Social Group F	●	○	○	○	●	n/a	n/a	n/a	n/a	n/a

Receptor	Feature	Impact/activity									
		Direct Mortality	Habitat Loss	Habitat Fragmentation	Disturbance	Pollution/ Sedimentation	Air Quality (NOx and Nitrogen Deposition)	Alien Species Transfer	Changes in Hydrology	Provision of Structures	Soil Compaction
Badger - operation	Social Group A	●	●	●	○	●	n/a	n/a	n/a	n/a	n/a
	Social Group B	●	○	○	○	●	n/a	n/a	n/a	n/a	n/a
	Population C	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a
	Social Group D	●	○	○	○	●	n/a	n/a	n/a	n/a	n/a
	Social Group E	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Social Group F	●	○	○	○	●	n/a	n/a	n/a	n/a	n/a
Bats - construction	Rosyth	○	○	●	●	○	n/a	n/a	n/a	n/a	n/a
	Inverkeithing	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Fairy Kirk	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Castlandhill Woods	●	○	●	●	○	n/a	n/a	n/a	n/a	n/a
	North Queensferry	○	○	●	○	○	n/a	n/a	n/a	n/a	n/a
	North Cliff Wood	○	○	●	○	○	n/a	n/a	n/a	n/a	n/a
	St. Margaret's Hope	●	○	●	●	●	n/a	n/a	n/a	n/a	n/a
	South Queensferry	○	○	●	○	○	n/a	n/a	n/a	n/a	n/a
	Port Edgar and west of South Queensferry	●	●	●	●	○	n/a	n/a	n/a	n/a	n/a
	Dundas (North)	●	○	●	●	○	n/a	n/a	n/a	n/a	n/a
	Dundas (Central)	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Dundas (South)	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Milton and Dolphington	●	●	●	○	○	n/a	n/a	n/a	n/a	n/a
	Humbie	○	○	●	○	○	n/a	n/a	n/a	n/a	n/a
	Kirkliston	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a
	Carmelhill and Muriehall	○	○	●	○	○	n/a	n/a	n/a	n/a	n/a
	Swineburn	○	○	●	○	○	n/a	n/a	n/a	n/a	n/a

Receptor	Feature	Impact/activity									
		Direct Mortality	Habitat Loss	Habitat Fragmentation	Disturbance	Pollution/ Sedimentation	Air Quality (NOx and Nitrogen Deposition)	Alien Species Transfer	Changes in Hydrology	Provision of Structures	Soil Compaction
	Ross's Plantation and Lindsay's Craigs	●	○	●	●	●	n/a	n/a	n/a	n/a	n/a
Bats - operation	Rosyth	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Inverkeithing	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Fairy Kirk	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Castlandhill Woods	○	●	○	○	○	n/a	n/a	n/a	n/a	n/a
	North Queensferry	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	North Cliff Wood	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	St. Margaret's Hope	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a
	South Queensferry	○	○	●	●	○	n/a	n/a	n/a	n/a	n/a
	Port Edgar and west of South Queensferry	●	●	●	●	○	n/a	n/a	n/a	n/a	n/a
	Dundas (North)	●	●	●	●	○	n/a	n/a	n/a	n/a	n/a
	Dundas (Central)	●	○	●	○	○	n/a	n/a	n/a	n/a	n/a
	Dundas (South)	●	○	●	○	○	n/a	n/a	n/a	n/a	n/a
	Milton and Dolphington	●	○	●	●	○	n/a	n/a	n/a	n/a	n/a
	Humbie	●	○	●	○	○	n/a	n/a	n/a	n/a	n/a
	Kirkliston	●	○	●	●		n/a	n/a	n/a	n/a	n/a
	Carmelhill and Muriehall	●	○	●	○	○	n/a	n/a	n/a	n/a	n/a
	Swineburn	●	○	●	●	●	n/a	n/a	n/a	n/a	n/a
	Ross's Plantation and Lindsay's Craigs	●	○	●	●	●	n/a	n/a	n/a	n/a	n/a
Terrestrial breeding birds -	Footprint of the Proposed Scheme	●	●	○	●	●	n/a	n/a	n/a	n/a	n/a

Receptor	Feature	Impact/activity									
		Direct Mortality	Habitat Loss	Habitat Fragmentation	Disturbance	Pollution/ Sedimentation	Air Quality (NOx and Nitrogen Deposition)	Alien Species Transfer	Changes in Hydrology	Provision of Structures	Soil Compaction
construction	St. Margaret's Marsh SSSI	●	●	○	●	●	n/a	n/a	n/a	n/a	n/a
Terrestrial breeding birds - operation	Footprint of the Proposed Scheme	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a
	St. Margaret's Marsh SSSI	●	●	○	●	●	n/a	n/a	n/a	n/a	n/a
Terrestrial wintering birds - construction	Footprint of the Proposed Scheme	●	●	○	●	●	n/a	n/a	n/a	n/a	n/a
	St. Margaret's Marsh SSSI	●	●	○	●	●	n/a	n/a	n/a	n/a	n/a
Terrestrial wintering birds - operation	Footprint of the Proposed Scheme	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a
	St. Margaret's Marsh SSSI	●	●	○	●	●	n/a	n/a	n/a	n/a	n/a
Otter - construction	Coast - Rosyth Europarc - North Queensferry	●	●	○	●	●	n/a	n/a	n/a	n/a	n/a
	Coast - Abercorn Point - Long Craig Pier	●	●	●	●	●	n/a	n/a	n/a	n/a	m/a
	Swine Burn, Niddry Burn, River Almond	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a
Otter - operation	Coast - Rosyth Europarc - North Queensferry	●	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Coast - Abercorn Point - Long Craig Pier	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Swine Burn, Niddry Burn, River Almond	●	●	●	○	●	n/a	n/a	n/a	n/a	n/a
Watervole - construction	Footprint of the Proposed Scheme	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a

Receptor	Feature	Impact/activity									
		Direct Mortality	Habitat Loss	Habitat Fragmentation	Disturbance	Pollution/ Sedimentation	Air Quality (NOx and Nitrogen Deposition)	Alien Species Transfer	Changes in Hydrology	Provision of Structures	Soil Compaction
Watervole - operation	Footprint of the Proposed Scheme	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
Red squirrels - construction	Footprint of the Proposed Scheme	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
Red squirrels - operation	Footprint of the Proposed Scheme	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
Amphibians - construction	Habitat west of Ferry Loch	●	●	○	●	○	n/a	n/a	n/a	n/a	n/a
	Footprint of the Proposed Scheme	●	●	○	●	○	n/a	n/a	n/a	n/a	n/a
Amphibians - operation	Habitat west of Ferry Loch	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Footprint of the Proposed Scheme	●	●	●	○	○	n/a	n/a	n/a	n/a	n/a
Reptiles - construction	Footprint of the Proposed Scheme	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
Reptiles - operation	Footprint of the Proposed Scheme	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
Terrestrial invertebrates - construction	St. Margaret's Hope Wood and St. Margaret's Marsh SSSI	●	○	○	●	○	n/a	n/a	●	n/a	●
	Ferry Hills SSSI	●	○	●	●	○	n/a	n/a	○	n/a	●
	Dundas Wood North	●	○	●	●	○	n/a	n/a	○	n/a	●
	Dolphington Burn Wood	●	○	●	●	○	n/a	n/a	●	n/a	●
	Ross's Plantation	●	○	○	●	○	n/a	n/a	○	n/a	●
	Parkland, West Kirkliston	●	○	○	●	○	n/a	n/a	○	n/a	●
	Lindsay's Craigs	●	○	○	●	○	n/a	n/a	○	n/a	●

Receptor	Feature	Impact/activity									
		Direct Mortality	Habitat Loss	Habitat Fragmentation	Disturbance	Pollution/ Sedimentation	Air Quality (NOx and Nitrogen Deposition)	Alien Species Transfer	Changes in Hydrology	Provision of Structures	Soil Compaction
	River Almond	○	○	○	○	○	n/a	n/a	○	n/a	●
Terrestrial invertebrates - construction	St. Margaret's Hope Wood and St. Margaret's Marsh SSSI	●	●	○	●	●	n/a	n/a	○	n/a	○
	Ferry Hills SSSI	●	●	●	●	●	n/a	n/a	○	n/a	○
	Dundas Wood North	●	●	●	●	●	n/a	n/a	○	n/a	○
	Dolphington Burn Wood	●	●	●	●	●	n/a	n/a	○	n/a	○
	Ross's Plantation	●	●	○	●	●	n/a	n/a	○	n/a	○
	Parkland, West Kirkliston	●	●	○	●	●	n/a	n/a	○	n/a	○
	Lindsay's Craigs	●	●	○	○	●	n/a	n/a	○	n/a	○
	River Almond	○	○	○	○	●	n/a	○	○	○	○
River habitat - construction	Swine Burn	n/a	●	●	○	●	n/a	n/a	●	n/a	n/a
	Swine Burn	n/a	○	○	○	○	n/a	n/a	○	n/a	n/a
	Niddry Burn	n/a	●	●	○	●	n/a	n/a	●	n/a	n/a
	River Almond	n/a	○	○	○	○	n/a	n/a	○	n/a	n/a
River habitat - operation	Swine Burn	n/a	●	●	○	●	n/a	n/a	●	n/a	n/a
	Swine Burn	n/a	○	○	○	○	n/a	n/a	○	n/a	n/a
	Niddry Burn	n/a	●	●	○	●	n/a	n/a	●	n/a	n/a
	River Almond	n/a	○	○	○	○	n/a	n/a	○	n/a	n/a
Aquatic macro-invertebrates - construction	Brankholm Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Unnamed Pond	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Estuarine Tributary	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Linn Mill Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Dolphington Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a

Receptor	Feature	Impact/activity									
		Direct Mortality	Habitat Loss	Habitat Fragmentation	Disturbance	Pollution/ Sedimentation	Air Quality (NOx and Nitrogen Deposition)	Alien Species Transfer	Changes in Hydrology	Provision of Structures	Soil Compaction
	Swine Burn	●	○	●	○	●	n/a	n/a	●	n/a	n/a
	Swine Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Swine Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Niddry Burn	●	○	●	○	●	n/a	n/a	●	n/a	n/a
	Niddry Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Niddry Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	River Almond	○	○	○	○	●	n/a	n/a	○	n/a	n/a
Aquatic macro-invertebrates - operation	Brankholm Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Unnamed pond	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Estuarine Tributary	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Linn Mill Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Dolphington Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Swine Burn	○	●	●	○	●	n/a	n/a	●	n/a	n/a
	Swine Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Swine Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Niddry Burn	○	●	●	○	●	n/a	n/a	●	n/a	n/a
	Niddry Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	Niddry Burn	○	○	○	○	○	n/a	n/a	○	n/a	n/a
	River Almond	○	○	○	○	●	n/a	n/a	○	n/a	n/a
Freshwater macrophytes - construction	Brankholm Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Linn Mill Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Dolphington Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Humbie Reservoir	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Swine Burn	○	○	●	n/a	●	n/a	n/a	●	n/a	n/a
	Swine Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Swine Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a

Receptor	Feature	Impact/activity									
		Direct Mortality	Habitat Loss	Habitat Fragmentation	Disturbance	Pollution/ Sedimentation	Air Quality (NOx and Nitrogen Deposition)	Alien Species Transfer	Changes in Hydrology	Provision of Structures	Soil Compaction
	Niddry Burn	○	○	○	n/a	●	n/a	n/a	●	n/a	n/a
	Niddry Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Niddry Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	River Almond	○	○	○	n/a	●	n/a	n/a	○	n/a	n/a
Freshwater macrophytes - operation	Brankholm Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Linn Mill Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Dolphington Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Humbie Reservoir	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Swine Burn	○	●	○	n/a	●	n/a	n/a	●	n/a	n/a
	Swine Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Swine Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Niddry Burn	○	●	○	n/a	●	n/a	n/a	●	n/a	n/a
	Niddry Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	Niddry Burn	○	○	○	n/a	○	n/a	n/a	○	n/a	n/a
	River Almond	○	○	○	n/a	●	n/a	n/a	○	n/a	n/a
Freshwater fish - construction	Swine Burn	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a
	Swine Burn	○	○	○	○	○	n/a	n/a	n/a	n/a	n/a
	Niddry Burn	●	●	●	●	●	n/a	n/a	n/a	n/a	n/a
	River Almond	○	○	○	○	●	n/a	n/a	n/a	n/a	n/a
Freshwater fish - operation	Swine Burn	○	●	●	●	●	n/a	n/a	n/a	●	n/a
	Swine Burn	○	○	○	○	○	n/a	n/a	n/a	○	n/a
	Niddry Burn	○	●	●	○	●	n/a	n/a	n/a	●	n/a
	River Almond	○	○	○	○	●	n/a	n/a	n/a	●	n/a

Table 4.2: Terrestrial Habitats: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - LSAP species for Edinburgh: two tree and shrub species, 26 herb and grass species and eight fern and lower plant species. LHAP habitats for Edinburgh: coastal and marine, rock faces, uplands, wetlands and watercourses, farmland semi-natural grassland, urban habitats and woodland. LSAP species for Fife: 15 herb and grass species, three fern and horsetail species and one bryophyte genus. LHAP habitats for Fife: coastal, farmland, moorland, rivers, standing water, unimproved/semi-improved grassland, urban and built habitat, wetlands and woodland. LHAP habitats for West Lothian: farmland, peat bogs, rivers and streams and woodland. **Legal Framework: Wildlife and Countryside Act 1981 (as amended) and Environmental Protection Agency Act 1990.** **Figure Reference: 10.2/10.3**				
Habitat Type: Reedbed and saltmarsh. Eastern section of St. Margaret's Marsh SSSI. Key Attributes: Mosaic of habitats comprising one of the largest expanses of reedbed in Fife, important habitat for breeding birds. Supports areas of herb-rich grassland and saltmarsh. Level of Importance: National.	Pollution	Impact Characterisation: • Extent: During the construction of, and activities associated with, access routes, particulates including discharge from machinery, sediments and exposed top soils may result in direct pollution. Pollution from roads can impact botanical species and wetland habitats directly by damage to vegetative structures or indirectly by impacting the quality of water that is absorbed by botanical species. • Effect: Direct and indirect negative. • Reversibility: Reversible. • Frequency: Constant. • Duration: Medium-term. • Likelihood of occurrence: Unlikely. Impact Magnitude: Low. Impact Significance: Significant negative impact.	• Generic Mitigation (Table 3.2.).	Not significant
	Alien species transfer	Impact Characterisation: • Extent: Japanese knotweed has been recorded within 50m of St. Margaret's Marsh and giant hogweed has been recorded within the SSSI boundary. The transfer of alien species is likely to occur during the creation of a temporary access road at the eastern end of the marsh in association with a construction basin and outfall. • Effect: Direct and indirect negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	• Surveys will be undertaken pre and post construction to confirm the detailed location of any alien species. If any are mapped then these areas, if they are out with the land take, shall be fenced and clearly marked to avoid vehicle incursion. Any alien species within the land take must also be clearly marked and soil from this area will have to be treated to ensure there is no transfer. • Ensure best practice (via method statements) amongst site staff to avoid intra and inter-site transfer of alien species. • An invasive weed management strategy is to be developed prior to the start of construction.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Legal Framework: Section 14 of the Wildlife and Countryside Act (WCA) 1981 (as amended) prohibits planting in the wild of plants listed in Part II of Schedule 9 or otherwise causing them to grow there. Furthermore, any Japanese knotweed contaminated soil or plant material that requires disposal is likely to be classified as "controlled waste" under Part II of the Environmental Protection Act 1990. It is an offence under Section 1a and 1b of this Act to deposit, treat, keep or dispose of controlled waste without a licence.		
Habitat Type: Woodland habitats at Castlandhill Woodlands, St. Margaret's Hope, South of Port Edgar Barracks, Inchgarvie House and Lindsay's Craigs. Key Attribute/s: Long-established habitats, unpolluted environment (air). Mosaic of habitats and connectivity. Level of Importance: Authority area.	Habitat Loss	Impact Characterisation: • Extent: It is likely that direct loss of woodland will occur as a result of the proposed creation of access routes (St. Margaret's Hope and woodland within the grounds of Inchgarvie House) towards site compound. There is also the potential loss of native bluebells which is a LSAP species for Fife and Edinburgh. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: Medium. Impact: Significance: Significant negative impact.	Vegetation clearance. • Minimise areas of vegetation clearance and demarcate clearly with fencing and signs, areas of retained vegetation and retained dead wood habitat. • Where the removal of trees is necessary, preference will be given to the selective removal of young and healthy trees over damaged or unhealthy trees. • Where removal of dead standing and fallen timber is necessary, the material will be relocated into areas of existing dead wood habitats and in areas adjacent to new woodlands. Relocated deadwood will be placed in areas of partial shade. • Piles of brash and smaller material will be placed in tightly packed, large litter piles in a range of aspects. New planting. • Offsetting the loss of ecologically important habitats will occur through habitat creation schemes, where appropriate. Direct habitat loss is also mitigated for by some roadside planting and will be integrated with habitat replacement, where possible. • Replacement habitat will be created through planting of hedgerows and woodland, with particular emphasis on the UK and Local BAP habitats and species. All planting will use native species of local provenance where available.	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: One area of mixed woodland has the potential to become severed by the construction of a temporary access route within the grounds of Inchgarvie House. Three hedgerows are going to be severed or removed by the proposed land-take during the construction of temporary access routes. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Medium-term. • Likelihood of occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: Bluebells are protected under the Wildlife and		

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Countryside Act 1981 (as amended).	• Part of the new woodland planting will be adjacent to existing woodland areas to both aid colonisation of the new woodland and enhance the retained woodland habitat. • Habitat enhancement of existing woodland to mitigate for the loss of woodland habitat suitable for protected species including badger and bats. • If native bluebells (LSAP species) are within the woodland areas designated for land take, these will be uprooted, translocated and used as "plant plugs" to aid new colonisation in suitable, adjacent woodland. • Management plans will be produced to ensure the woodland condition is maintained and developed.	
	Alien species transfer	Impact Characterisation: • Extent: Japanese knotweed has been recorded at St. Margaret's Hope and in close proximity to woodland at Port Edgar and adjacent to Society Road. Giant hogweed has been recorded alongside broad-leaved plantation woodland south of Port Edgar at NT 11919 78580. Alien species transfer has potential to occur throughout the route corridor, especially at sites near to habitats where alien species exist. • Effect: Direct and indirect negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Medium-term. • Likelihood of occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	• As per mitigation outlined for control of alien species transfer in St. Margaret's Marsh SSSI.	Not significant
Habitat Type: Water bodies, including the Swine Burn, Niddry Burn and River Almond. Key Attributes: Environment (water), mosaic of habitats	Disturbance	Impact Characterisation: • Extent: Disturbance to riparian habitats and associated water bodies is likely to occur during construction activities in close proximity to these areas. Watercourses and associated riparian habitats include: Swine Burn (realignment of Swine Burn west of Junction 1A, ch1750-2200), Niddry Burn (ch1100 along M9) and River Almond (M9, south of M9 Junction 1A, ch500-600).	• The proposed scheme construction will be carried out under current best practice, adhering to SEPA pollution prevention guidelines, which will reduce the risk of a water pollution incident occurring. A method statement/action plan will be developed with the Client, their agents and SEPA to set out the appropriate course of action should a water	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
and connectivity. Level of Importance: Local		• Effect: Direct and indirect negative. • Reversibility: Irreversible in immediate area of impact. • Frequency: Recurring. • Duration: Medium-term. • Likelihood of occurrence: Unlikely. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	pollution incident occur. • No stockpiling of material within 10m of any watercourse. • Use of clean substrate when reinstating the stream bed. • Manage for appropriate flows where possible to maximise the benefits of natural silt removal.	
Habitat Type: Species Rich Grassland situated to the west of and northeast of Castlandhill wood. Key Attributes: Unpolluted environment (air), species-rich habitat and connectivity. Level of Importance: Authority area.	Disturbance	Impact Characterisation: • Extent: Grassland habitats would be sensitive to high reoccurring disturbance levels that would occur if site compound and access road is sited in close proximity to this habitat type, causing potential changes in plant community type and habitat quality. • Effect: Direct negative • Reversibility: Reversible. • Frequency: Single event. • Duration: Medium-term. • Likelihood of occurrence: Extremely unlikely. Impact Magnitude: Low. Impact Significance: Significant negative impact.	• The area of species-rich grassland will be avoided, where possible, for use as a temporary site compound. • A method statement will be prepared in advance for all areas where tree and scrub removal is required. The Contractors Ecological Clerk of Works (ECoW) will be present on site to monitor vegetation removal and associated activities.	Not significant
	Alien species transfer	Impact Characterisation: • Extent: New Zealand pygmyweed (*Crassula helmsii)* has been recorded in a dry pond/swamp in the field adjacent to and to the northeast of Castlandhill wood. Alien species transfer has potential to occur throughout the route corridor, especially at sites near to habitats where alien species exist. • Effect: Direct and indirect negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Medium-term. • Likelihood of occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	As per mitigation outlined for control of alien species transfer in St. Margaret's Marsh SSSI.	Not significant

Table 4.3: Badgers: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - Badger are listed on the 'Scottish Biodiversity List' under the Nature Conservation (Scotland) Act 2004; they are in both the Fife and Edinburgh LBAPs, and are listed on the Trunk Roads BAP. **Legal Framework: Protection of Badgers Act 1992 and Schedule 6 of the Wildlife and Countryside Act 1981 (as amended). See Appendix A10.2 for more information.** **Figure Reference: Confidential Badgers Figures 1 - 2.**				
Social Group A and Population C. Location: Confidential. Key Attributes: Woodland and scrub setting habitat and grassland foraging habitat. Level of Importance: Local (Group A).and Authority area (Group C).	Direct Mortality	Impact Characterisation: • Extent: **Group A:** Limited to setting and foraging habitat in the eastern section of this territory where construction work and site clearance is to take place. One main sett would be lost within this area. **Group C:** Limited to setting and foraging habitat in the northern section of this territory. Two outlier setts and one main sett would be lost within this area. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Near certain. Impact Magnitude: High Impact Significance: Significant negative impact. Legal Framework: It is an offence to deliberately or recklessly kill or disturb a badger under the above legislation.	Generic Mitigation (Table 3.2.).	Not significant
	Disturbance	Impact Characterisation: • Extent: **Group A:** Limited to setting and foraging habitat in the eastern section of this territory where construction work and site clearance is to take place. **Group C:** Limited to setting and foraging habitat in the northern area of the presumed territory only (approximately 9ha). The closest remaining sett lies approximately 290m from the proposed scheme. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2.).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Legal Framework: As detailed above.		
	Pollution	Impact Characterisation: • Extent: Limited to potential contamination, via chemical spills, of foraging habitat in the northern section of this territory. Pollution can lead to infertility or mortality through ingestion of contaminants. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Extremely unlikely. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
Social Group B. Location: Confidential. Key Attributes: Woodland and scrub setting habitat and grassland foraging habitat. Level of Importance: Authority area.	Direct Mortality	Impact Characterisation: • Extent: Limited to foraging habitat at the northeast edge of the presumed territory only. No setts were recorded in this area. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Extremely unlikely. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
Social Group D and Social Group F. Location: Confidential. Key Attributes: Grassland foraging habitat.	Direct Mortality	Impact Characterisation: • Extent: Limited to foraging habitat edges of the presumed territories only. No setts were recorded in these areas. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Unlikely.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Level of Importance: Authority area.		Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
	Pollution	Impact Characterisation: • Extent: Limited to potential contamination, via chemical spills, of foraging habitat at the northern and eastern edges of the presumed territory only. Pollution can lead to infertility or mortality through ingestion of contaminants. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Extremely unlikely. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant

Table 4.4: Bats: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - All bat species, except for common pipistrelle, are listed on Appendix II of the Council of Europe Convention on European Wildlife and Natural Habitats (the Bern Convention 1979). West Lothian and Fife have LBAPs for all bat species. Edinburgh has LSAPs for common (*Pipistrellus pipistrellus*), soprano (*P. pygmaeus*) and Nathius' pipistrelles (*P. nathusii*) and Daubenton's bats (*Myotis daubentonii*). **Legal Framework: Habitats Directive 1992 (Annex IV); and Conservation (Natural Habitats & c) Regulations 1994.** **Figure Reference: Figure 10.4/Figure 10.5**				
Location: Rosyth. Key Attributes: Urban area with high roosting potential and limited foraging and commuting potential.	Disturbance and Habitat Fragmentation	Impact Characterisation: • Extent: Potential disturbance of bat commuting activity between Inverkeithing and Rosyth during construction due to presence of site compound, access routes and realignment of B981 and associated bridge over the railway. This is likely to be exacerbated if night works are used. • Effect: Indirect negative. • Reversibility: Reversible.	Generic Mitigation (Table 3.2). Specific mitigation: • Adherence to light pollution mitigation measures within the vicinity of commuting habitat along the Rosyth - Inverkeithing railway. • Retention of existing flight lines along the Rosyth -	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Level of Importance: Local.		• Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: It is an offence under the Conservation (Natural Habitats, & c.) Regulations 1994 as amended to intentionally or recklessly kill or injure a bat, destroy any place which is used for breeding, resting or roosting by a bat or alter features which are integral to maintaining breeding or hibernation roosts.	Inverkeithing railway by keeping bridges and tunnels open at night.	
Location: Castlandhill Wood. Key Attributes: A mature woodland with a small urban area, surrounded by arable fields with good commuting routes. Level of Importance: Local.	Direct Mortality	Impact Characterisation. • Extent: Tree felling and clearance for construction at Castlandhill Woods will involve limited amount of tree felling including trees with roost potential. Potential mortality or injury to any bats roosting in trees to be felled. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Clearance for construction may reduce suitability of the B980 and verges for commuting bats. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
	Disturbance	Impact Characterisation: • Extent: Possible disturbance of commuting routes and foraging areas due to lighting and blasting during construction. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific mitigation: • Provision of replacement roosting habitat (bat boxes) in nearby trees (roosts to be monitored). • Adherence to light pollution mitigation measures at the edge of Castlandhill Woods.	Not significant
Location: St. Margaret's Hope. Key Attributes: Mature broad-leaved woodland with excellent roosting, foraging and commuting habitat. Level of Importance: Authority area	Direct Mortality	• Extent: Tree felling and clearance for construction in St. Margaret's Hope will involve felling of mature and semi-mature trees with roost potential. Potential mortality or injury to any bats roosting in trees to be felled. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Near certain. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Habitats will be fragmented temporarily with sections of woodland either side of access road and compound during construction. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Retention of existing flight line along the main road and under the Forth Road Bridge at night by ensuring that flight lines are not obstructed and that light pollution mitigation measures are followed.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
	Disturbance	Impact Characterisation: • Extent: Disturbance of roosting, foraging and commuting bats likely due to blasting, drilling and clearance of vegetation for construction, as well as lighting during construction. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific mitigation: • Provision of alternative roost habitat as above. • Adherence to light pollution mitigation measures in vicinity of St. Margaret's Hope Wood or commuting routes. • Dark areas and natural screens to be provided to ensure bat activity is not disrupted.	Not significant
	Pollution	Impact Characterisation: • Extent: Polluted discharge into St. Margaret's Marsh may affect suitability of this foraging habitat resource. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single events. • Duration: Short-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2.).	Not significant
Location: North Cliff Wood. Key Attributes: Mature broad-leaved woodland with roosting, foraging and commuting habitat. Level of Importance: Local.	Habitat Fragmentation	Impact Characterisation: • Extent: Possible indirect severance of foraging and commuting habitats by disruption of commuting routes due to construction of bridge and siting of access road and site compound. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2.). Specific Mitigation: Retention of existing flight line along the main road and under the Forth Road Bridge at night by ensuring that flight lines are not obstructed and that light pollution mitigation measures are followed.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Location: North Queensferry. Key Attributes: Urban area with roosting potential and commuting routes including Forth Road and Rail bridges. Level of Importance: Authority area.	Habitat Fragmentation	Impact Characterisation: • Extent: Possible indirect severance of foraging and commuting habitats by disruption of commuting routes due to construction of bridge and siting of access road and site compound. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2). Specific Mitigation: Retention of existing flight line along the main road and under the Forth Road Bridge at night by ensuring that flight lines are not obstructed and that light pollution mitigation measures are followed.	Not significant
Location: South Queensferry. Key Attributes: Large urban area with roosting, foraging and commuting habitat supporting Locally significant bat populations. Level of Importance: Authority area.	Habitat Fragmentation	Impact Characterisation: • Extent: Severance of commuting routes used by pipistrelle and *Myotis* spp. e.g. CR 21 due to construction of road between South Queensferry and Dundas. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Retention of existing flight lines along the A8000, minor road at White Gate and the A905 by ensuring that commuting routes are not obstructed and that light pollution mitigation measures are followed.	Not significant
Location: Port Edgar Barracks and West of South Queensferry. Key Attributes: Mixture of woodland and arable land with hedgerows, tree lines and woodlands forming the connective links between this area and other adjoining areas. Good roosting, foraging and commuting	Direct Mortality	Impact Characterisation: • Extent: Tree felling and clearance for blasting and construction at Inchgarvie and alongside Society Road will involve felling of mature and semi-mature trees with roost potential. Potential mortality or injury to any bats roosting in trees to be felled. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
habitat and hibernaculum potential. Level of Importance: Authority area.		Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
	Habitat Loss	Impact Characterisation: Extent: There would be a loss of mature broad-leaved woodland in the area of Inchgarvie House and along Society Road, reducing the overall availability of suitable bat habitat. Effect: Direct negative. Reversibility: Irreversible. Frequency: Single event. Duration: Short-term. Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Provision of alternative roost habitat as above.	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: The severance of commuting routes and foraging areas for bats, between South Queensferry, East Shore Wood, and Hopetoun which will affect habitat connectivity in the study area. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Retention of existing flight line along Society Road (CR 12) and hedgerow at Inchgarvie (CR 13) by ensuring that routes are not obstructed and that light pollution mitigation measures are followed.	Significant negative impact of negligible magnitude
	Disturbance	Impact Characterisation: • Extent: Lighting, blasting, drilling and clearance for construction of access roads may deter commuting bats within this area e.g. CR 13. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Constant.	Generic Mitigation (Table 3.2). Specific mitigation: Provision of alternative roost habitat as above. Adherence to light pollution mitigation measures in vicinity of Inchgarvie, the Society Road or Port	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Edgar Barracks.	
Location: Dundas (North). Key Attributes: Mosaic of habitat types including semi-improved grassland and mature broad-leaved woodland at the Echline Strip. Excellent roosting, foraging and commuting habitat. Level of Importance: Authority area.	Direct Mortality	Impact Characterisation. • Extent: Tree felling and clearance for construction at the Echline Strip will involve felling of mature and semi-mature trees with roost potential. Potential mortality or injury to any bats roosting in trees to be felled. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Near certain. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: The severance of excellent highly used commuting routes e.g. commuting routes 23 and 25 and foraging areas for bats, particularly those roosting within Dundas. This would affect the connectivity and the movement of bats from south to north throughout the study area. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Retention of existing flight lines along the A8000, minor road at White Gate and the A904 (Builyeon Road) by keeping commuting routes open and that light pollution mitigation measures are followed.	Not significant
	Disturbance	Impact Characterisation: • Extent: Lighting used during the construction phase would have a negative effect on bat activity. Also, the removal of trees from the Echline	Generic Mitigation (Table 3.2). Specific mitigation:	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Strip may have an adverse effect on bat foraging and roosting behaviour in the locality. • Construction disturbances may also affect the level to which roosts at Dundas Mains and Ashley Cottages are used for roosting. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Provision of alternative roost habitat as above. Adherence to light pollution mitigation measures in vicinity of the Echline Strip.	
Location: Milton and Dolphington. Key Attributes: Mixed woodland and linear features suitable for roosting, foraging and commuting pipistrelles. Level of Importance: Local.	Direct Mortality	Impact Characterisation: • Extent: No known roosts to be affected. Small area of tree felling and clearance for construction alongside the M9 for construction of bus lanes will involve felling of mature and semi-mature trees with roost potential. Potential mortality or injury to any bats roosting in trees to be felled. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Loss	Impact Characterisation: • Extent: Loss of woodland on either side of the A90. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium.	Generic Mitigation (Table 3.2). Specific Mitigation: Provision of alternative roost habitat as above. Hedge and tree planting along bus lanes on both sides of M9. Mixed woodland planting adjacent to bus lane on north side of the M9.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
	Habitat Fragmentation	Impact Characterisation: • Extent: Severance of commuting route between Dalmeny and South Queensferry, and Dundas and Dolphington along CR 24 due to construction activities. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Hedge and tree planting along bus lanes on both sides of M9.	Not significant
Location: Swineburn, Humbie and Carmelhill and Muriehall. Key Attributes: Hopetoun Fisheries pond, broad-leaved and mixed plantation woodland with good foraging potential; roosts and potential roosts. Quarry pond provides aquatic foraging resource; good connectivity to high value habitats in adjacent areas. Level of Importance: Swineburn and Humbie Authority area.; Carmelhill and Muiriehall, Local.	Habitat Fragmentation	Impact Characterisation: • Extent: Indirect severance of commuting routes along Swine Burn as a result of junction construction at the M9 Link. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2). Specific Mitigation: Retention of existing flight lines along Swine Burn, the B9080 and the River Almond by ensuring that culverts and bridges are not obstructed at night.	Not significant
Location: Kirkliston. Key Attributes: Suburban	Direct Mortality	Impact Characterisation: • Extent: No known roosts to be affected. Small area of tree felling and clearance for construction alongside the M9 and adjacent to the M9 Link	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
area with amenity and grassland habitats. River Almond, Niddry Burn and Back Braes Weir provide excellent roosting and foraging; good connectivity to the rest of the study area. Level of Importance: Authority area		Road for junction improvements will involve felling of mature and semi-mature trees with roost potential. Potential mortality or injury to any bats roosting in trees to be felled. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: It is an offence under the Conservation (Natural Habitats, and c.) Regulations 1994 (as amended) to intentionally or recklessly kill or injure a bat.		
	Habitat Loss	Impact Characterisation: • Extent: Loss of woodland and riparian habitat on either side of the M9 Link and potential loss of foraging and commuting habitat along Swine Burn if bats cannot cross as a result of clearance for construction and embankments. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Provision of alternative roost habitat as above.	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Severance of Swine Burn due to obstruction of existing culvert and alteration of flight routes due to earthworks and construction activities, including construction of a new culvert, will prevent bats flying safely across the M9 Link at this location. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event.	Generic Mitigation (Table 3.2). Specific Mitigation: Retention of existing flight lines along Swine Burn, the B9080 and the River Almond by ensuring that culverts and bridges are not obstructed at night.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
	Disturbance	Impact Characterisation: • Extent: Night works and construction activities will have a negative effect on commuting and foraging bats along the Niddry Burn, Swine Burn and River Almond and in woodland areas. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific mitigation: Provision of alternative roost habitat as above. Adherence to light pollution mitigation measures in vicinity of Kirkliston, Swine Burn and associated aquatic and wetland habitat, or the River Almond.	Not significant
	Pollution	Impact Characterisation: • Extent: Potential pollution events at Niddry Burn and downstream impacts on the River Almond with impacts on prey habitat resource. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single events. • Duration: Short-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
Location: Ross's Plantation, Lindsay's Craigs and Overton. Key Attributes: Mixed broad-leaved woodland and	Direct Mortality	Impact Characterisation: • Extent: No known roosts to be affected. Small area of tree felling and clearance for construction alongside the M9 will involve felling of mature and semi mature trees with roost potential. Potential mortality or injury to any bats roosting in trees to be felled. • Effect: Direct negative.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
grassland habitats, Niddry Burn and M9 verges. Level of Importance: Authority area.		• Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: It is an offence under the Conservation (Natural Habitats, and c.) Regulations 1994 (as amended) to intentionally or recklessly kill or injure a bat, destroy any place which is used for breeding, resting or roosting by a bat or alter features which are integral to maintaining breeding or hibernation roosts.		
	Habitat Fragmentation	Impact Characterisation: • Extent: Temporary severance of Niddry Burn during road and junction improvement works may affect bats' ability to cross the M9 safely between habitats either side of the road. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Constant. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Retention of existing flight line along Niddry Burn by keeping culvert open at night and adherence to light pollution mitigation measures around culvert openings and along flight lines towards them.	Not significant
	Disturbance	Impact Characterisation: • Extent: Night works and construction activities will have a negative effect on commuting and foraging bats along Niddry Burn and in the woodland areas. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low.	Generic Mitigation (Table 3.2). Specific mitigation: Provision of alternative roost habitat as above. Adherence to light pollution mitigation measures in vicinity of Ross's Plantation, Lindsay's Craigs and Niddry Burn.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
	Pollution	Impact Characterisation: • Extent: Potential pollution events at Niddry Burn and downstream impacts on the River Almond with impacts on prey habitat resource. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single events. • Duration: Short-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant

Table 4.5: Terrestrial Breeding Birds: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - **Ground Nesting Birds: Lapwing (*Vanellus vanellus*) (AL, UB & LB), curlew (*Numenius arquata*), skylark (*Alauda arvensis*) (AL, UB & LB), grasshopper warbler (*Locustella naevia*) (RL & UB), reed bunting (*Emberiza schoeniclus*) (RL, UB & LB) and grey partridge (*Perdix perdix*) (RL, UB & LB).** **Scrub and Hedgerow Nesting Birds: Bullfinch (*Pyrrhula pyrrhula*) (RL, UB & LB), linnet (RL, UB & LB), willow warbler (*Phylloscopus trochilus*) (AL) and yellowhammer (RL, UB & LB).** **Tree and Woodland Nesting Birds: Goldcrest (*Regulus regulus*) (AL), great spotted woodpecker (*Dendrocopus major*) (LB), green woodpecker (*Picus viridis*) (AL), kestrel (*Falco tinnunculus*) (AL) and song thrush (*Turdus philomelos*) (RL, UB & LB).** **Riparian Nesting Birds: Gadwall (*Anaws strepera*) (AL) and sand martin (*Riparia riparia*) (AL & LB).** **Other Species: Barn owl (S1, AL & LB), house martin (*Delichon urbica*) (AL), house sparrow (*Passer domesticus*) (RL & UB), starling (*Sturnus vulgaris*) (RL & UB), swallow (*Hirundo rustica*) (AL) and swift (*Apus apus*) (LB).** **Key: S1=WCA 1i. RL=JNCC Red List, AL=JNCC Amber List, UB=UKBAP, LB=LBAP.** **Legal Framework: Wildlife and Countryside Act 1981 (as amended) and Nature Conservation (Scotland) Act 2004.** **Figure Reference: Figure 10.6.**				
Location: Footprint of the proposed scheme including temporary locations for site compounds, access roads, easements and working areas. (Proposed access routes at Inchgarvie House, through St. Margaret's Hope and towards the east of St. Margaret's Marsh SSSI. Proposed site compounds in poor semi-improved grassland south of Inchgarvie House).	Direct Mortality	Impact Characterisation: • Extent: Site compounds, access roads or other temporary infrastructure. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Implication: It is an offence under the Wildlife and Countryside Act 1981 and Nature Conservation (Scotland) Act 2004 to intentionally or recklessly kill, injure or take any wild bird; take, damage or destroy the nest of any wild bird while it is in use or being built; and take or destroy the egg of any wild bird	Generic Mitigation (Table 3.2).	Not significant
	Habitat Loss	Impact Characterisation: • Extent: Site compounds, access roads or other temporary infrastructure. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Impact Magnitude: Low. Impact Significance: Significant negative impact (all groups except wetland nesting birds). Legal Implication: As detailed above.		
	Disturbance	Impact Characterisation: • Extent: Site compounds, access roads or other temporary infrastructure. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact (ground nesting birds). Legal Implication: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Pollution	Impact Characterisation: • Extent: Site compounds, access roads or other temporary infrastructure, with the exception of shrub and hedgerow or tree and woodland nesting bird assemblages where the impact is not applicable. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Unlikely. Impact Magnitude: Low. Impact Significance: Significant negative impact (ground nesting birds). Legal Implication: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
Location: St. Margaret's Marsh SSSI Key Attributes: Assemblage of breeding bird territories including reed bunting, water rail and willow	Direct Mortality	Impact Characterisation: • Extent: Proposed construction activities at St. Margaret's Marsh including realignment of B981 and movement of site traffic. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Short-term.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
warbler. Level of Importance: Authority area		• Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Implication: As detailed above.		
	Habitat Loss	Impact Characterisation: • Extent: Proposed construction activities at St. Margaret's Marsh including realignment of B981 and movement of site traffic. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Implication: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Disturbance	Impact Characterisation: • Extent: Proposed construction activities at St. Margaret's Marsh including realignment of B981 and movement of site traffic. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Pollution	Impact Characterisation: • Extent: Proposed construction activities at St. Margaret's Marsh including realignment of B981 and movement of site traffic. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Constant risk throughout construction. • Duration: Short-term.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Implication: As detailed above.		

Table 4.6: Terrestrial Wintering Birds: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - **Tree & Woodland: Goldcrest (AL), great spotted woodpecker (LB) and song thrush (RL, UB & LB).** **Scrub & Hedgerow: Bullfinch (RL, UB & LB), house sparrow (UB & RL), starling (UB & RL), fieldfare (*Turdus pilaris*) (S1, LB), redwing (*Turdus iliacus*) (S1, AL) and yellowhammer (UB & RL).** **Arable/Grassland: Lapwing (AL, UB & LB), curlew (AL, UB & LB), kestrel (AL), grey partridge (UB, LB & RL), linnet (RL & LB) and skylark (RL, UB & LB)** **Wetland & watercourse: Cormorant (*Phalacrocorax carbo*) (AL), reed bunting (RL, UB & LB), common snipe (*Gallinago gallinago*) (AL & LB), mallard (*Anas platyrhynchos*) and greylag goose (*Anser anser*) (A1, S1 & AL).** **Key: A1=Annex 1 species, S1=WCA 1i. RL=JNCC Red List, AL=JNCC Amber List, UB=UKBAP, LB=LBAP** **Legal Protection: Wildlife and Countryside Act 1981 (as amended) and Nature Conservation (Scotland) Act 2004** **Figure Reference: Figure 10.6.**				
Location: Footprint of the proposed scheme including temporary locations for site compounds, access roads, easements and working areas (proposed access routes at Inchgarvie House, through St. Margaret's Hope and towards the east of St. Margaret's SSSI. Proposed site compounds in poor semi-improved grassland south of Inchgarvie House).	Direct Mortality	Impact Characterisation: • Extent: Site compounds, access roads or other temporary infrastructure. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Implication: It is an offence under the Wildlife and Countryside Act 1981 (as amended) and Nature Conservation (Scotland) Act 2004 to intentionally or recklessly kill, injure or take any wild bird; take, damage or destroy the nest of any wild bird while it is in use or being built; and take or destroy the egg of any wild bird.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Key Attributes: Foraging and Roosting: Agricultural fields - Arable crop fields. Grassland: Pasture, semi-improved and improved grassland. Scrub and Hedgerow: Areas of scattered and continuous scrub, newly planted woodland <5m height, tall ruderal vegetation and hedgerows. Trees and Woodland: Scattered trees, hedgerow standards and mature woodland (plantation and semi-natural). Wetland and watercourse: Riparian and Aquatic habitat. Level of Importance: Authority area	Habitat Loss	Impact Characterisation: • Extent: Site compounds, access roads or other temporary infrastructure. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Implication: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Disturbance	Impact Characterisation: • Extent: Site compounds, access roads or other temporary infrastructure. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Implication: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Pollution	Impact Characterisation: • Extent: Site compounds, access roads or other temporary infrastructure, with the exception of scrub and hedgerow or tree and woodland wintering bird assemblages where the impact is not applicable. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Unlikely. Impact Magnitude: Low. Impact Significance: Significant negative impact (wetland and water birds). Legal Implication: As detailed above.	Generic Mitigation (Table 3.2).	Not significant

Table 4.7: Otter: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - Otter are priority species in the UKBAP UK, and are listed as an LBAP species in Fife and the City of Edinburgh. Legal Framework: Habitats Directive 1992 (Annex IV), Conservation (Natural Habitats & c) Regulations 1994 and Nature Conservation (Scotland) Act 2004. Figure Reference: Confidential Figure 3.				
Location: Coast - Rosyth Europarc - North Queensferry. Key attribute: Important coastal area. St. Margaret's Marsh has extensive undisturbed area of reeds suitable for breeding; St. Margaret's Marsh provides excellent lying up potential. Small pools provide washing sites. Level of Importance: Authority area.	Direct Mortality	Impact Characterisation: • Extent: Proposed construction activities at St. Margaret's Marsh and adjacent areas including realignment of B981 and movement of site traffic are likely to cause significant changes to present activity levels therefore resulting in an increased risk of mortality caused by RTA or falls into pits. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single/recurring. • Duration: Permanent. • Likelihood of Occurrence: Unlikely. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Loss	Impact Characterisation: • Extent: Loss of foraging habitat and lying up areas including reedbed (St. Margaret's Marsh) due to temporary infrastructure. No known lying up sites would be affected. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant:
	Disturbance	Impact Characterisation: • Extent: St. Margaret's Marsh is currently subject to very low levels of	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		disturbance. Construction activities including the B981 realignment and bridge pier construction are likely to significantly increase disturbance levels from noise, lighting and vibration. Disturbance may affect otter use of resources including reducing likelihood of otters using the area for breeding. No known lying up sites would be affected. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Recurring. • Duration: Medium-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.		
	Pollution	Impact Characterisation: • Extent: There is potential for pollution of water courses including fresh and brackish water at St. Margaret's Marsh due to accidental spills. Pollution of the coastal area may reduce availability of prey items or reduce suitability of crustaceans and molluscs as food items, and may make pools unsuitable for fur washing. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Single event (s). • Duration: Short to medium-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
Location: Coast - Abercorn Point - Long Craig Pier Key Attributes: Important coastal area. Extensive shoreline with excellent prey base; sheltered woodland areas including East Shore Wood; abundant lying up	Direct Mortality	Impact Characterisation: • Extent: Proposed construction activities at Port Edgar Barracks and Marina including, bund, access platform and pier construction and movement of site traffic is likely to cause significant changes to present traffic levels therefore increased risk of mortality caused by RTA or falls into pits. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single/recurring. • Duration: Permanent.	Generic Mitigation (Table 3.2). Specific mitigation: Incorporate mammal underpass into access platform to ensure commuting route along the shore is maintained and the risk of mortality is reduced.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
potential and commuting potential. Level of Importance: Authority area.		• Likelihood of Occurrence: Unlikely. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
	Habitat Loss	Impact Characterisation: • Extent: Loss of foraging habitat and lying up areas situated adjacent to the coast and on the shore. Otters are likely to forage along the coast and lie up in adjacent woodland areas such as East Shore Wood and plantation woodland at Inchgarvie, therefore clearance for access roads may cause loss of lying up habitat. No known lying up sites would be affected. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: It is an offence under the Conservation (Natural Habitats, and c.) Regulations 1994 (as amended) to interfere with any otter lying up site without an EPS licence.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Severance of East Shore Wood by access roads and severance of shore habitats due to presence of bund and construction access platform and construction materials. This has potential to affect otter use of resources, especially if commuting routes inland (Linn Mill Burn) become effectively blocked. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2). Specific mitigation: Incorporate mammal underpass into access platform to ensure commuting route along the shore is maintained.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
	Disturbance	Impact Characterisation: • Extent: Otters are likely to forage along the coast and lie up in woodland reaches and cavities in boulders. Increased human activity, the presence of pier construction materials at Port Edgar Barracks and increased levels of noise, vibration and light are likely to cause significant increases in disturbance. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Recurring. • Duration: Medium-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Pollution	Impact Characterisation: • Extent: Potential for pollution of water courses due to accidental spills. Pollution of the coastal area may reduce availability of prey items or reduce suitability of crustaceans and molluscs as food items. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Single event (s). • Duration: Short to medium-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: None	Generic Mitigation (Table 3.2).	Not significant
Locations: Swine Burn Niddry Burn River Almond	Direct Mortality	Impact Characterisation: • Extent: Direct mortality of otter during works. Risk of otters entering work site and becoming trapped in pits, piping, chemical containers or wire mesh and risk of RTA on work access roads. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single/recurring. • Duration: Permanent.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Key Attributes: Core area of otter activity with abundant lying up sites and high value foraging and commuting habitat. Level of Importance: Authority area.		• Likelihood of Occurrence: Probable. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: It is an offence under the above legislation to intentionally or recklessly capture, injure or kill an otter.		
	Habitat Loss	Impact Characterisation: • Extent: Otter forage along river and burns and lie up in woodland and scrub areas. • Construction activities undertaken within 10m of water courses may cause loss of riparian habitat. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above	Generic Mitigation (Table 3.2).	Short term: Significant negative impact of low magnitude Long term: Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Severance of otter home ranges and commuting habitats along the River Almond, Niddry Burn and Swine Burn due to M9 widening, junction improvements and construction of embankments. Changes to culvert/underpasses currently in use. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Short term: Significant negative impact of low magnitude Long term: Not significant
	Disturbance	Impact Characterisation: • Extent: Otters are likely to suffer disturbance from increased light, noise and vibration from construction activities.	Generic Mitigation (Table 3.2).	Short term: Significant negative impact

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Recurring. • Duration: Medium-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		of low magnitude Long term: Not significant
	Pollution	Impact Characterisation: • Extent: Potential for pollution of water courses due to accidental spills. Pollution of water courses adjacent to road scheme may reduce availability of prey items available. • Effect: Indirect and direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short to medium-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant

Table 4.8: Amphibians: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - Great crested newt (*Lissotriton cristatus*) is a UKBAP and Fife and Edinbrugh City Council LBAP species. Common frog (*Rana temporaria*) is a Fife Council LBAP species. Common toad (*Bufo bufo*) is a Fife and Edinburgh City Council LBAP species. **Legal Framework: Habitats Directive 1992 (Annex IV), Conservation (Natural Habitats & c) Regulations 1994, Wildlife and Countryside Act 1981 (as amended) and Nature Conservation (Scotland) Act 2004.** **Figure Reference: Figure 10.9.**				
Location: Suitable terrestrial habitat to the west of Ferry Loch (Ferry Hills SSSI). Key Attributes: Great crested newts and assemblages of common amphibians. Level of Importance: National	Direct Mortality	Impact Characterisation: • Extent: Limited to the area cleared for construction at the Ferrytoll Junction ch7200-7500. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: Under the above legislation it is illegal to kill, possess or disturb a great crested newt. It is also illegal to damage, destroy or obstruct any structure used by a great crested newt.	Generic Mitigation (Table 3.2). Specific mitigation: • A detailed hand search will be undertaken under licence from the Scottish Government to clear the area of any amphibians prior to construction. • Amphibian exclusion fencing will be installed between ch7200-ch7500 (on east side of the highway only) where applicable/practicable and through consultation with Scottish Natural Heritage to prevent the movement of amphibians back into cleared areas.	Not significant
	Habitat Loss	Impact Characterisation: • Extent: Habitat loss: Limited to the area cleared for construction at the Ferrytoll Junction ch7200-7500. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Disturbance	Impact Characterisation: • Extent: Limited to the area cleared for construction at the Ferrytoll Junction ch7200-7500. • Effect: Direct negative.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.		
Location: Suitable terrestrial habitats throughout the remainder of the proposed scheme including habitats at NT 113 787 and NT 114 779 Key Attributes : Assemblages of common amphibian species comprising common frog, common toad, smooth and palmate newt. Level of Importance: Local.	Direct Mortality.	Impact Characterisation: • Extent: Areas used for site compounds, access routes or other temporary areas. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: High. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Loss	Impact Characterisation: • Extent: Habitat loss for site compounds and access or other temporary areas (refer to Terrestrial Habitats). • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Disturbance	Impact Characterisation: • Extent: habitat loss for site compounds and access or other temporary areas (refer to Terrestrial Habitats). • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.		

Table 4.9: Terrestrial Invertebrates: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - Red Data Book (RDB3) (1 species), Notable (9 species), Scottish Biodiversity List (12 species), LBAP (12 species). Figure Reference: Figure 10.9.				
Receptor: Terrestrial Invertebrates. Locations: 2 - Ferry Hills SSSI 3 - Dundas Wood North 4 - Dolphington Burn Wood Key Attributes: Mosaic of habitats including; woodlands, dead wood, scrub, grasslands, waterbodies and wetlands. Level of Importance: Local	Habitat Fragmentation	Impact Characterisation: • Extent: Two small areas of woodland would be fragmented by the proposed scheme at sites 3 and 4. One area of semi-improved/acid grassland would be fragmented by the proposed scheme at site 2. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
Receptor: Terrestrial Invertebrates. Locations: 1 - St. Margaret's Hope Wood and St. Margaret's Marsh SSSI;	Direct Mortality	Impact Characterisation: • Extent: Direct loss of: Poor semi-improved grassland habitat including areas at site 2. Improved grassland habitat including areas at site 2. Woodland habitat including areas at sites 1, 3, 5, 4, 6, and 7 within the footprint of the proposed scheme. • Effect: Direct negative.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
2 - Ferry Hills SSSI; 3 - Dundas Wood North; 4 - Dolphington Burn Wood; 5 - Ross's Plantation; 6 - Parkland West Kirkliston; and 7 - Lindsay's Craigs. .Key Attributes: Mosaic of habitats including; woodlands, dead wood, scrub, grasslands, waterbodies and wetlands. Level of Importance: Local		• Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Certain. Impact Magnitude: Medium. Impact Significance: significant negative impact.		
Receptor: Terrestrial Invertebrates. Locations: 1 - St. Margaret's Hope Wood and St. Margaret's Marsh SSSI; and 4 - Dolphington Burn Wood. Key Attributes: Mosaic of habitats including; woodlands, dead wood, scrub, grasslands, waterbodies and wetlands. Level of Importance: Local	Changes to Hydrology	Impact Characterisation: • Extent: Reedbed habitat at site 1 and wet woodland at site 4. • Effect: Indirect negative and positive as wet habitats will be lost, but new drier habitats will be developed. • Reversibility: Irreversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2). Specific mitigation: In collaboration with stakeholders, a management plan will be produced to enhance habitats at St. Margaret's Marsh.	Not significant
Receptor: Terrestrial Invertebrates. Locations: 1 - St. Margaret's Hope Wood and St. Margaret's	Disturbance	Impact Characterisation: • Extent: Disturbance may arise in areas of direct land take including: Poor semi-improved grassland habitat including areas at site 2 improved grassland habitat including areas at site 2 woodland habitat including areas at sites 1, 3, 4, 5, 6 and 7 within the footprint of the proposed scheme.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Marsh SSSI; 2 - Ferry Hills SSSI; 3 - Dundas Wood North; 4 - Dolphington Burn Wood; 5 - Ross's Plantation; 6 - Parkland, West Kirkliston; and 7 - Lindsay's Craigs. Key Attributes: Mosaic of habitats including; woodlands, dead wood, scrub, grasslands, waterbodies and wetlands. Level of Importance: Local		• Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring event. • Duration: Short-term. • Likelihood of occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.		
Receptor: Terrestrial Invertebrates. Locations: 1 - St. Margaret's Hope Wood and St. Margaret's Marsh SSSI 2 - Ferry Hills SSSI 3 - Dundas Wood North 4 - Dolphington Burn Wood 5 - Ross's Plantation 6 - Parkland West Kirkliston 7 - Lindsay's Craigs Key Attributes: Mosaic of habitats including; woodlands, dead wood, scrub, grasslands, waterbodies and wetlands. Level of Importance: Local	Soil Compaction.	Impact Characterisation: • Extent: Soil compaction may arise in areas of direct land-take including: Poor semi-improved grassland habitat including areas at site 2; improved grassland habitat including areas at site 2; woodland habitat including areas at sites 1, 3, 4, 6 and 7 within the footprint of the proposed scheme. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant

Table 4.10: River Habitat: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Figure Reference: Figure 10.11.				
Location: Swine Burn JA08, JA09 Niddry Burn JA12 River Almond JA14 Key Attributes: In-channel and riparian habitat. Level of Importance: Authority area: Swine Burn JA08, Niddry Burn JA12, River Almond JA14. Local: Swine Burn JA09.	Habitat Loss	Impact Characterisation: • Extent: Potential loss of riparian and in-channel habitat from culvert and/or realignment on Swine Burn (ch1750-2200), Niddry Burn (ch1100). • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: Medium Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Length of culvert. Potential fragmentation of in-channel and riparian habitat at the Swine Burn (ch1750-2200) and Niddry Burn (ch1100). • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Changes to Hydrology	Impact Characterisation: • Extent: Extent: Potential alteration to hydrology affecting in-channel and riparian habitat at the Swine Burn (ch1750-2200) and Niddry Burn (ch1100). Effects on flow related to structures will be local whereas increased road run-off from compounds may be more widespread. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Constant. • Duration: Permanent.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Likelihood of Occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact.		
	Water Pollution	Impact Characterisation: • Extent: Potential for local and downstream impacts on the Swine Burn, Niddry Burn and River Almond leading to loss of river habitat. • Potential for considerable downstream impacts, not just in the local area. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring (construction compound run-off); Single event (accidental spillage). • Duration: Short to medium-term (compound run-off and/or accidental spillage). • Likelihood of Occurrence: Probable. Impact Magnitude: Low/Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant

Table 4.11: Aquatic Macroinvertebrates: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Legal Framework: Water Framework Directive (European Directive 2000/60/EC). **Figure Reference: Figure 10.11.**				
Location: JA01 Brankholm Burn JA02 Unnamed tributary JA03 Unnamed pond JA04 Linn Mill Burn JA05/06 Dolphington Burn JA08/09 Swine Burn JA10/11/13 Niddry Burn	Direct Mortality	Impact Characterisation: • Extent: There is potential for loss of the invertebrate community limited to the length of section to be dewatered for watercourse realignment or culvert construction on the Swine Burn (ch1750-2200) and Niddry Burn (ch1100). • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Permanent (though re-colonisation can occur once construction	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
JA14 River Almond Key Attributes: Aquatic macroinvertebrate community and biological water quality. Level of Importance: Regional: Niddry Burn. Authority area: Unnamed pond, Unnamed estuarine tributary, Swine Burn River Almond. Local: Brankholm Burn, Linn Mill Burn, Dolphington Burn.		phase complete). • Likelihood of Occurrence: Certain. Impact Magnitude: Low/Moderate. Impact Significance: Significant negative impact.		
	Habitat Fragmentation	Impact Characterisation: • Extent: There is potential for fragmentation of the invertebrate community limited to the period during dewatering for watercourse realignment or culvert construction on the Swine Burn (ch1750-2200) and Niddry Burn (ch1100). • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Single event (short period). • Duration: Short-term (during dewatering phase). • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Changes to Hydrology.	Impact Characterisation: • Extent: The potential alteration of flow patterns may affect the aquatic habitat and invertebrate communities on the Swine Burn (ch1750-2200) and Niddry Burn (ch1100) in the vicinity of the dewatered or redirected sections. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Water pollution/ Sedimentation	Impact Characterisation: • Extent: Potential contamination and sedimentation of the Swine Burn, Niddry Burn and River Almond may affect the aquatic community, not just locally but also downstream. • Effect: Direct and indirect negative. • Reversibility: Reversible in time through re-colonisation.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Frequency: Single event. • Duration: Medium-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low Impact Significance: Significant negative impact. Legal Framework: Notable pollution events are an offence under the Environment Protection Act 1990.		

Table 4.12: Freshwater Macrophytes: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Legal Framework: Water Framework Directive (European Directive 2000/60/EC). **Figure Reference: Figure 10.11.**				
Location: JA01 Brankholm Burn. JA04 Linn Mill Burn. JA06 Dolphington Burn. JA07 Humbie Reservoir. Watercourses: JA08/09 (Swine Burn). JA10/12/13 Niddry Burn. JA14 River Almond. Key Attributes: Attributes required for a diverse macrophyte community are wet habitat, varying degrees of flow/ water level, varying degrees of shade, varying degrees of water quality.	Habitat Fragmentation	Impact Characterisation: • Extent: Direct loss of aquatic habitat Swine Burn (JA09) within the footprint of the proposed scheme. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of occurrence: Certain. • Significance: Significant negative impact. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Pollution	Impact Characterisation: Extent: Linn Mill Burn (JA04), Swine Burn (JA09: ch1750 2200), Niddry Burn (JA13) and River Almond (JA14). • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Level of Importance: Local for all sites.		• Likelihood of occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.		
	Changes in Hydrology	Impact Characterisation: Extent: Potential changes in hydrology resulting in loss of aquatic habitat - Swine Burn (JA09: ch1750-2200) and Niddry Burn (JA13). • Direct: Negative as wet habitats will be altered. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of occurrence: Probable. Impact Magnitude: Negligible. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant

Table 4.13: Freshwater Fish: Specific Impacts, Mitigation and Residual Impacts - Construction

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - Brown trout and European eel are species of conservation concern in the UK BAP and have a significant commercial importance. Atlantic salmon, sea trout and river lamprey, have LSAPs for the City of Edinburgh. **Legal Framework: EC Freshwater Fish Directive (2006/44/EC); Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act (2003); and Conservation (Natural Habitats & c.) Regulations (1994). All freshwater fish species are protected under the Salmon and Freshwater Fisheries Act (2003).** **Figure Reference: Figure 10.11.**				
Location: Swine Burn JA08. Swine Burn JA09 Niddry Burn JA12 River Almond JA14 Downstream of construction activity. Key Attribute(s): Fish species (brown trout,	Direct Mortality	Impact Characterisation: • Extent: Limited to the length of section to be dewatered for realignment and/or culvert construction at Swine Burn (JA09: ch1750-2200) and Niddry Burn (ch1100). • Effect: Direct negative. • Reversibility: Reversible (through re-colonisation). • Frequency: Single event. • Duration: Medium-term. • Likelihood of occurrence: Certain. Impact Magnitude: Moderate.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
bullhead, minnow, three-spined stickleback) and the heterogeneous habitat needed to support the existing fish communities. Level of Importance: Authority area: Swine Burn JA08 Regional: Swine Burn JA09, Niddry Burn JA12, River Almond JA14.		Significance: Significant negative impact. Legal Framework: Any person who knowingly injures or disturbs any salmon spawn; or disturbs any spawning bed or any bank or shallow in which the spawn of salmon may be, shall be guilty of an offence under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003.		
	Re-suspension of Sediment	Impact Characterisation: • Extent: Swine Burn (JA09: ch1750-2200), Niddry Burn (JA12), River Almond (JA14). Potential for negative impacts further downstream (not localised). The re-suspension of sediment and subsequent smothering of gravels may act as a limiting factor on the availability of food (macroinvertebrates) and/or reduce in-stream vegetation. Subsequently, available cover from predators will be reduced, potentially resulting in displacement of fish from the reach. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework As above.	Generic Mitigation (Table 3.2).	Not significant
	Construction Site Run-off	Impact Characterisation: • Extent: Swine Burn, Niddry Burn, River Almond. • Potential for negative impacts further downstream (not localised). • Effect: Direct/Indirect negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Loss	Impact Characterisation: • Extent: Swine Burn (JA09: ch1750-2200), Niddry Burn (JA12: ch1100). Limited to the length of section to be dewatered for culvert construction and potentially up to 100 metres either side. The associated impact of habitat	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		fragmentation during construction is limited to the length of section to be dewatered and the period of construction works. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
	Habitat Fragmentation	Impact Characterisation: • Extent: Swine Burn (JA09), Niddry Burn. Dewatering lengths of watercourse to construct culverts and realign the watercourse will prevent the free passage of fish. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Constant. • Duration: Short-term. • Likelihood of occurrence: Certain. Impact Magnitude: Moderate. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Noise and Vibration (including piling.	Impact Characterisation: • Extent: Swine Burn (JA09: ch1750-2200), Niddry Burn (JA12: ch1100). Habitat avoidance is likely to occur by migratory species (salmonids) during the construction phase. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
	Light Pollution	Impact Characterisation: • Extent: Swine Burn (JA09: ch1750-2200), Niddry Burn (JA11: ch1100). The impact is likely to be exacerbated in the immediate vicinity of works for resident species such as bullhead and migratory species with disruption of normal nocturnal behaviour. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant

Table 4.14: Terrestrial Habitats: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - LSAP species for Edinburgh: two tree and shrub species, 26 herb and grass species and eight fern and lower plant species). LHAP habitats for Edinburgh: coastal and marine, rock faces, uplands, wetlands and watercourses, farmland semi-natural grassland, urban habitats and woodland. LSAP species for Fife: 15 herb and grass species, three fern and horsetail species and one bryophyte genus. LHAP habitats for Fife: coastal, farmland, moorland, rivers, standing water, unimproved/semi-improved grassland, urban and built habitat, wetlands and woodland. LHAP habitats for West Lothian: farmland, peat bogs, rivers and streams and woodland. **Legal Framework: Wildlife and Countryside Act 1981 (as amended) and Environmental Protection Act 1990.** **Figure Reference: Figure 10.2/Figure 10.3.**				
Habitat Type: Eastern and northern section of St. Margaret's Marsh SSSI. Key Attributes: Mosaic of habitats, unpolluted environment (air and water), one of the largest expanses of reedbed in Fife, important habitat for breeding birds. Supports areas of herb-rich	Habitat Loss	Impact Characterisation: • Extent: The proposed construction of a detention basin and outfall in the east section of St. Margaret's Marsh will result in the potential loss of tall ruderal vegetation. The realignment of the B981 will result in loss of approximately 1% of the reedbed habitat (a qualifying feature of the SSSI) as well as tall ruderal vegetation and wood and scrub across the eastern and northern part of St. Margaret's Marsh. • Effect: Direct negative. • Reversibility: Irreversible in immediate area of impact. • Frequency: Single event.	Generic Mitigation (Table 3.2). In consultation with SNH a mitigation strategy to enhance the habitat has been adopted. A number of options for improving the site are potentially available; and a commitment to implement a management strategy in consultation with SNH to enhance the site's condition has been agreed.	Significant positive impact of medium magnitude

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
grassland and saltmarsh. Level of Importance: National.		• Duration: Permanent. • Likelihood of occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.		
	Changes to hydrology	Impact Characterisation: • Extent: Changes to the hydrological regime in St. Margaret's Marsh during the construction of a detention basin and outfall has the potential to alter the drainage of the area resulting in changes in vegetation composition. • Effect: Indirect negative. • Reversibility: Irreversible in immediate area of impact. • Frequency: Recurring. • Duration: Permanent. • Likelihood of occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Specific Mitigation: • The embankment of the realigned B981 would be constructed of permeable and semi-permeable material to ensure that overland flow is directed into the marsh. • Further studies and monitoring of the hydrology of the area affected will be carried out to determine whether mitigation is required.	Not significant
Habitat Type: Woodland habitats including Castlandhill woodlands, St. Margaret's Hope, woodland south of Port Edgar Barracks, woodland within the grounds of Inchgarvie House, the Echline Strip woodlands on the Dundas Estate, woodland along the northern side of M9 Junction 1A and woodland at Lindsay's Craigs. Key Attributes: Long-established habitats, unpolluted environment (air). Mosaic of habitats and connectivity.	Habitat Loss	Impact Characterisation: • Extent: Woodland habitat loss will occur at St. Margaret's Hope (ch6800-7200), at Port Edgar Barracks (ch4500) within the grounds of Inchgarvie House (ch4450-4500), at the Echline Strip woodlands on the Dundas Estate (ch2200-2500 and ch2650-2900) and plantation woodland adjacent to the M9 Junction 1A (ch1800-2100). In addition, there will be a small loss of woodland at Castlandhill wood and Lindsay's Craigs (ch1250-1300). This loss would also result in a potential loss of bluebells which is a Fife and Edinburgh LSAP species. There is likely to be a permanent loss of woodland habitat of approximately: • 1.2ha of broad-leaved plantation woodland; • 0.9ha of mixed plantation woodland; • 0.1ha of coniferous plantation woodland; and • 4.9ha semi-natural broad-leaved woodland. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain.	Generic Mitigation (Table 3.2). Specific Mitigation: • Part of the new woodland planting will be adjacent to existing woodland areas to both aid colonisation of the new woodland and enhance the retained woodland habitat, (replacement planting at ch2700-2900 south of Queensferry Junction, to offset the loss of woodland habitat of the Echline strip, and reinforce the woodland patterning and replacement planting at Castlandhill to connect existing woodlands there). • If native bluebells (LBAP species) are within the woodland areas designated for land-take, these will be uprooted, translocated and used as "plant plugs" to aid new colonisation in suitable, adjacent woodland. • Management plans will be produced to ensure the woodland condition is maintained and developed.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Level of Importance: Authority area		Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: The deliberate, unauthorised destruction of bluebells constitutes an offence under the Wildlife and Countryside Act 1981 (as amended).		
	Habitat Fragmentation	Impact Characterisation: • Extent: Three areas of woodland would be severed by the construction of the road including St. Margaret's Hope, woodland within the grounds of Inchgarvie House and the Echline strip. Ten hedgerows are going to be severed or removed by the proposed land-take. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.		
	Pollution	Impact Characterisation: • Extent: Road spray, drainage and run-off may contain chemical contaminants such as petrol, diesel, oils, antifreeze and other substances derived from motor vehicles, which may have a potential negative effect on the botanical elements of the proposed scheme. The effect of road spray could impact habitats and vegetation along the entire length of the proposed scheme. • Effect: Direct. • Reversibility: Reversible. • Frequency: Constant. • Duration: Permanent. • Likelihood of occurrence: Unlikely. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
Habitat Type: Ferry Hills SSSI. Key Attributes: Mosaic of	Changes to Hydrology	Impact Characterisation: • Extent: Changes to the hydrological regime of the seasonally flooded basin mire at Ferry Hills SSSI has potential to occur during cutting and embankment works at the proposed scheme, although there will be no	Generic Mitigation: None. Specific Mitigation: • Areas of the seasonally flooded basin mire that	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
habitats, connectivity and biological interest for its unimproved grassland. Level of Importance: National.		direct impacts to this habitat. • Effect: Indirect negative. • Reversibility: Irreversible in immediate area of impact. • Frequency: Recurring. • Duration: Medium-term. • Likelihood of occurrence: Unlikely. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	are not directly impacted by the proposed scheme will be maintained so that the current suitable hydrological condition that is currently afforded by the poor drainage characteristics of the area will be retained. • Landscape mitigation alongside the cutting will retain the landscape integrity of Ferry Hills as a SSSI (ch7300-7800 along the merge slip road). • Details regarding the measures that will be implemented to mitigate for adverse hydrological impacts are provided in Chapter 9 (Water Environment).	
Habitat Type: Grassland. Situated at western end of cemetery, Inverkeithing. Key Attributes: Presence of maiden pink (*Dianthus deltoides*), a LBAP species for Fife. Level of Importance: Authority area.	Habitat Loss	Impact Characterisation: • Extent: There is potential for the loss of an authority area species located at the western end of the cemetery at the edge of the rock face above the A90 (ch8250-8300), due to the reconstruction of the cutting. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Unlikely. Impact Magnitude: High. Impact Significance: Significant negative impact.	Generic Mitigation: None. Specific Mitigation: • Species translocation - involving the physical removal of plants and seed bank from one location to another will be undertaken, prior to any construction works, at the site where maiden pink was recorded. Maiden pink is a shallow rooted plant that reproduces both vegetatively and by seed. It grows well in open areas, on shallow, moderately acidic and infertile soils. It is likely to respond well in the long-term to translocation activities, provided a suitable location for the plant is found. • A method statement will be prepared in advance for the process of translocation. An Ecological Clerk of Works will be present on site to monitor translocation activities.	Not significant
Habitat Type: Water bodies including the Swine Burn, Niddry Burn and River Almond. Key Attributes: Unpolluted environment (water), mosaic of habitats and connectivity.	Habitat Loss	Impact Characterisation: • Extent: A stretch of riparian habitat will be lost along the Swine Burn between ch1750-2200 due to watercourse realignment. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent.	Generic Mitigation: None. Specific Mitigation: Riparian planting along the new alignment of the Swine Burn will result in a greater diversity of species and habitats than is currently present.	Significant positive impact of medium magnitude

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Level of Importance: Local.		• Likelihood of occurrence: Probable. Impact Magnitude: High. Impact Significance: Significant negative impact.		
	Pollution	Impact Characterisation: • Extent: Road spray, drainage and run-off may contain chemical contaminants such as petrol, diesel, oils, antifreeze and other substances derived from motor vehicles, which may have a potential negative effect on the botanical elements of riparian habitats along the proposed scheme. The effect of road spray could impact habitats, vegetation and water quality along the entire length of the proposed scheme. • Effect: Direct. • Reversibility: Reversible. • Frequency: Constant. • Duration: Permanent. • Likelihood of occurrence: Unlikely. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant

Table 4.15: Badger: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - Badger are present on the 'Scottish Biodiversity List' under the Nature Conservation (Scotland) Act 2004; they are in both the Fife and Edinburgh LBAPs, and are listed on the Trunk Roads BAP. **Legal Framework: Protection of Badgers Act 1992 and Schedule 6 of the Wildlife and Countryside Act 1981 (as amended). See Annex 1, Section 1.2 for more information.** **Figure Reference: Confidential Badgers Figures 1 - 2**				
• Social Group A. Location: Confidential. Key Attributes: Woodland and scrub setting habitat and grassland foraging habitat.	Direct Mortality	Impact Characterisation: • Extent: Risk of RTA limited to foraging habitat at the eastern side of the presumed territory only. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent.	Generic Mitigation: None. Specific Mitigation: Badger-resistant fencing to be provided at ch1700-4300.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Level of Importance: Local.		• Likelihood of Occurrence: Extremely unlikely. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: It is an offence to deliberately, or recklessly kill a badger under the Protection of Badgers Act 1992 and Wildlife and Countryside Act 1981 (as amended).		
	Habitat Loss	Impact Characterisation: • Extent: Limited to foraging habitat at the eastern side of the presumed territory due to construction of a detention basin. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative effect.	Generic Mitigation: None. Specific Mitigation: • A replacement sett will be created in line with best practice and under consultation with SNH. There is the opportunity to relocate the sett in the area of grassland as the existing sett. • Fencing used around the detention basin will allow access for badgers. The detention basin will provide foraging habitat.	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Limited to foraging habitat in the east section of this territory. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation: None. Specific Mitigation: Access under the road viaduct and retention of existing hedgerow up to the abutment at ch4350 will allow access to the eastern section of the social group's territory.	Not significant
	Pollution	Impact Characterisation: • Extent: Limited to potential contamination, via run-off, of foraging habitat at eastern section of the presumed territory only. Pollution can lead to infertility or mortality through ingestion of contaminants. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Likelihood of Occurrence: Extremely unlikely. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
• Social Group B. Location: Confidential. Key Attributes: Woodland and scrub setting habitat and grassland foraging habitat. Level of Importance: Authority area.	Direct Mortality	Impact Characterisation: • Extent: Risk of RTA limited to foraging habitat at the northeast edge of the presumed territory only. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Extremely unlikely. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation: None. Specific Mitigation: Badger-resistant fencing to be provided at ch1700-4300.	Not significant
	Pollution	Impact Characterisation: • Extent: Limited to potential contamination, via run-off, of foraging habitat at the northeast edge of the presumed territory only. Pollution can lead to infertility or mortality through ingestion of contaminants. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Extremely unlikely. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
• Population C. Location: Confidential. Key Attributes: Woodland and scrub setting habitat and grassland foraging habitat.	Direct Mortality	Impact Characterisation: • Extent: Risk of RTA in the northern section of this territory. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent.	Generic Mitigation: None. Specific Mitigation: Badger-proof fencing as well as a badger underpass between ch2800-2900, (with planting designed to filter badgers through the underpass to be provided at ch1700-4300).	Not Significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Level of Importance: Authority area.		• Likelihood of Occurrence: Probable. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
	Habitat Loss	Impact Characterisation: • Extent: Limited to setting (approximately 3ha) and foraging habitat (approximately 6ha) in the northern section of this territory. Two outlier setts and one main sett would be lost within this area. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation: None. Specific Mitigation: The loss of the setting habitat will be ameliorated by creation of broad-leaved woodland habitat as part of the offset mitigation proposals will ameliorate this impact. A replacement sett will be created in line with best practice and under consultation with SNH. There is the opportunity to relocate the sett in the same area of woodland as it is unoccupied by any other badger setts. Alternatively the sett could be relocated within the Echline Strip as there is a clear path leading to a subsidiary sett in this area. This will ensure the replacement sett is located within the correct social group's territory and as such, bait marking is not deemed necessary.	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Limited to foraging habitat in the northern section of this territory. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation: None. Specific Mitigation: A badger underpass will be provided near to an existing commuting route north of the Echline Strip between ch2800-2900. Badgers will be encouraged to use the underpass via sensitive planting, which will filter them towards the underpass.	Not significant
	Disturbance	Impact Characterisation: • Extent: Limited to setting and foraging habitat in the northern area of the presumed territory only (approximately 9ha). The closest remaining sett lies approximately 290m from the proposed scheme. • Effect: Direct negative.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Reversibility: Reversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
	Pollution	Impact Characterisation: • Extent: Limited to potential contamination, via run-off, of foraging habitat in the northern section of this territory. Pollution can lead to infertility or mortality through ingestion of contaminants. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
Social Group D. Location: Confidential. Key Attributes: Grassland foraging habitat. Level of Importance: Authority area.	Direct Mortality	Impact Characterisation: • Extent: Limited to a small area of foraging habitat at the eastern edge of the presumed territory only. No setts were recorded in this area. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Unlikely. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation: None. Specific Mitigation: Badger-resistant fencing to be provided at ch400-2600.	Not significant
	Pollution	Impact Characterisation: • Extent: Limited to potential contamination, via run-off, of foraging habitat at the eastern edge of the presumed territory only. Pollution can lead to infertility or mortality through ingestion of contaminants.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Unlikely. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
Social Group F. Location: Confidential. Key Attributes: Woodland and scrub setting habitat and grassland foraging habitat. Level of Importance: Authority area.	Direct Mortality	Impact Characterisation: • Extent: Risk of RTA limited to foraging habitat at the northern and eastern edges of the presumed territory only. No setts were recorded in this area. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation: None. Specific Mitigation: Badger-proof fencing to be provided at ch400-2600.	Not significant
	Pollution	Impact Characterisation: • Extent: Limited to potential contamination, via run-off, of foraging habitat at the northern and eastern edges of the presumed territory only. Pollution can lead to infertility or mortality through ingestion of contaminants. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Unlikely. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant

Table 4.16: Bats: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - All bat species, except for common pipistrelle, are listed on Appendix II of the Council of Europe Convention on European Wildlife and Natural Habitats (the Bern Convention 1979). West Lothian and Fife have LBAPs for all bat species. Edinburgh has LSAPs for common (*Pipistrellus pipistrellus*), soprano (*P. pygmaeus*) and Nathius' pipistrelles (*P. nathusii*) and Daubenton's bats (*Myotis daubentonii*). **Legal Framework: Habitats Directive 1992 (Annex IV); and Conservation (Natural Habitats & c) Regulations 1994. See Annex 1 for more information.** **Figure Reference: Figure 10.4/Figure 9.5.**				
Location: Castlandhill Woods. Key Attributes: A mature woodland with a small urban area, surrounded by arable fields with good commuting routes.	Habitat Loss	Impact Characterisation: • Extent: Permanent loss of small area of woodland habitat may affect availability of roosting and foraging habitat not scarce in the vicinity. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: It is an offence under the Conservation (Natural Habitats, & c.) Regulations 1994 as amended to intentionally or recklessly kill or injure a bat, destroy any place which is used for breeding, resting or roosting by a bat or alter features which are integral to maintaining breeding or hibernation roosts.	Generic Mitigation (Table 3.2). Specific Mitigation: Provision of bat boxes to replace lost roost opportunities elsewhere in Castlandhill Woods as per construction mitigation. Replacement roosting and foraging habitat to be provided at Castlandhill Woods with mixed woodland planting to tie in with the existing habitat.	Not significant
Location: St. Margaret's Hope. Key Attributes: Mature broad-leaved woodland with excellent roosting, foraging and commuting habitat. Level of Importance: Authority area.	Direct Mortality	Impact Characterisation: • Extent: Bats attempting to cross the proposed scheme are vulnerable to being struck by oncoming vehicles. The proposed scheme would be at-grade at the top of St. Margaret's Hope; out with this, bats would be able to fly under the approach viaducts. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
	Habitat Loss	Impact Characterisation: • Extent: Loss of mature woodland habitat with high roosting and foraging potential; loss of foraging and roosting habitat either side of the proposed scheme if bats cannot cross. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic mitigation (Table 3.2). Specific Mitigation: Mixed woodland habitat creation as per Castlandhill Woods above. Replacement bat boxes to be provided elsewhere in St. Margaret's Hope Wood as per construction mitigation above.	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Habitat will be effectively bisected by the road, fragmenting the wood and associated foraging and roosting habitat. Viaduct will be high enough that bats can fly underneath but bats will not be able to cross the road safely where the road is at grade. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Adherence to light pollution mitigation measures at St. Margaret's Hope above will ensure dark commuting routes are retained between roosting and foraging habitat at North Cliff and St. Margaret's Hope.	Not significant
	Disturbance	Impact Characterisation: • Extent: Disruption of bat activity likely if lights shine onto surrounding habitat and if dark foraging and flight paths are not maintained. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short term. • Likelihood of Occurrence: Certain. Impact magnitude: Low.	Generic Mitigation (Table 3.2). Specific Mitigation: Adherence to light pollution mitigation measures at St. Margaret's Hope will maintain dark areas which bats can use for foraging and commuting. Flight paths under the viaducts to be maintained to ensure that bats can fly underneath.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
	Pollution	Impact Characterisation: • Extent: Polluted run-off from the road or structure may affect suitability of St. Margaret's Marsh as a foraging habitat resource for bats which roost in St. Margaret's Hope. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Occasional events. • Duration: Short-term. • Likelihood of occurrence: Unlikely. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
Location: North Queensferry. Key Attributes: Urban area with roosting potential and commuting routes including Forth Road and Rail bridges. Level of Importance: Authority area.	Habitat Creation.	Impact Characterisation: • Extent: The Main Crossing will provide a third structure along which bats may commute between Fife and Lothians, enriching the commuting habitat resource at Authority area importance. • Effect: Indirect positive. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Certain. Impact Magnitude: Medium. Impact Significant: Significant positive impact.	Generic Mitigation: None. Specific Mitigation: Maintenance of newly created habitats alongside the new road.	Positive significant impact of high magnitude
Location: South Queensferry. Key Attributes: Large urban area with roosting, foraging and commuting habitat supporting locally significant bat populations.	Habitat Fragmentation	Impact Characterisation: • Extent: Permanent severance of commuting routes between South Queensferry and habitats to the west and south e.g. Dundas. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain.	Generic Mitigation (Table 3.2). Specific Mitigation: A8000, Minor road at White Gate and A905 to be enhanced with linear planting to encourage bats to use these structures to cross the proposed scheme safely. Linear planting including hedgerow and standard trees along the carriageway will be planted in such a way that bats can use it to navigate	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Level of Importance: Local.		Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	between safe crossing points. Gantries at approximately ch3400 and approximately ch2750 will be utilised as bat bridges to provide safe crossing points over the proposed scheme. Gantry at location approximately 250m east of ch1500 will be utilised as a bat bridge to reconnect CR 24.	
	Disturbance	Impact Characterisation: • Extent: Junction and road lighting may affect activity patterns of foraging and commuting bats in this area. Unlikely to represent a significant change from current lighting on bat activity in South Queensferry itself. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Constant. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Adherence to light pollution mitigation measures along the new A90 section.	Not significant
Location: Port Edgar Barracks and West of South Queensferry. Key Attributes: Mixture of woodland and arable land with hedgerows, tree lines and woodlands forming the connective links between this area and other adjoining areas. Good roosting, foraging and commuting habitat and hibernaculum potential. Level of Importance: Authority area.	Habitat Loss	Impact Characterisation: • Extent: Permanent loss of mature broad-leaved woodland in the area of East Shore Wood, Inchgarvie and along Society Road, reducing the overall presence of suitable bat habitat in the area. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Near certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific mitigation: Provision of linear planting alongside carriageway will replace lost commuting habitat. Bat box provision at East Shore Wood as per construction mitigation. .	Not significant
	Direct Mortality and Habitat Fragmentation	Impact Characterisation: • Extent: The severance of commuting routes and foraging areas for bats, between South Queensferry, East Shore Wood and Hopetoun will affect	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		habitat connectivity in the study area. Commuting route along Society Road likely to be retained due to the presence of a raised viaduct at this location. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Near certain. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Specific Mitigation: Provision of linear planting alongside the proposed scheme to direct bats toward safe crossings under the viaduct (Inchgarvie and the Society Road) and at the A905. Planting of hedge and standard trees alongside the A905 and minor road at White Gate will ensure that this feature is maintained as a suitable crossing point and commuting route.	
	Disturbance	Impact Characterisation: • Extent: Permanent lighting and traffic noise on the Main Crossing may deter bats from using roosts and potential hibernacula at Port Edgar Barracks and permanently affect the suitability of the area for foraging and commuting. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Constant. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Adherence to light pollution mitigation measures in the vicinity of the guard house roost at Port Edgar Barracks. Provision of alternative roosting habitat as above.	Not significant
Location: Dundas (North). Key Attributes: Mosaic of habitat types including semi-improved grassland and mature broad-leaved woodland at the Echline Strip. Excellent roosting, foraging and commuting habitat.	Habitat Loss	Impact Characterisation: • Extent: Permanent or part-removal of sections of the Echline Strip and associated woodland areas will result in the loss of high value roosting, foraging and commuting habitat and fragment the remaining habitat areas. Roost loss may result in the loss of maternity or hibernation roost resource scarce in the locality. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent.	Generic Mitigation (Table 3.2). Specific Mitigation: Replacement habitat to be provided in the Echline Strip with mixed woodland planting to tie in with existing habitats. Replacement bat boxes to be provided elsewhere in the Echline Strip as per construction mitigation above.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Level of Importance: Authority area.		• Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
	Direct Mortality and Habitat Fragmentation	Impact Characterisation: • Extent: The permanent fragmentation of woodland areas and severance of important commuting routes (e.g. CRs 7 and 12) will disrupt flight lines and affect connectivity within Dundas and the wider area. Possible implications in terms of RTA. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Gantries at approximately ch3400 and approximately ch2750 will be utilised as bat bridges to provide safe crossing points over the proposed scheme. Gantry at location approximately 250m east of ch1500 will be utilised as a bat bridge to reconnect CR 11. Linear planting including hedgerow and standard trees along the carriageway and along the A8000, the minor road at White Gate and the A905, will be planted in such a way that bats can use it to navigate between safe crossing points.	Not significant
	Disturbance	Impact Characterisation: • Extent: Road and junction lighting in the area may directly affect the suitability of bat roosts (e.g. Ashley Cottages, tree roosts in Echline Strip). Presence of road will affect the suitability of flight lines and may affect distribution of bats through the landscape. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Constant. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Adherence to light pollution mitigation measures at the Echline Strip or Ashley Cottage roosts.	Not significant
Location: Dundas (Central) and Dundas (South). Key Attributes: Mosaic of	Direct Mortality and Habitat Fragmentation	Impact Characterisation: • Extent: Permanent severance of linear features between Dundas and habitats to the north/east of the estate (including South Queensferry, Dalmeny and Kirkliston) will affect the movement of bats in the landscape	Generic Mitigation (Table 3.2). Specific Mitigation:	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
woodland and shelterbelt habitats, water bodies, buildings, an ice house and a quarry. Excellent value bat habitat, part of a large area. Level of Importance: Authority area.		and affect the availability of roosting, foraging and hibernating sites at Authority area importance. Possible implications in terms of RTA. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Certain. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	A8000, minor road at White Gate and A905 to be enhanced with linear planting to encourage bats to use these structures to cross the road safely. Linear planting including hedgerow and standard trees along the carriageway will be planted in such a way that bats can use it to navigate between safe crossing points.	
Location: Milton and Dolphington. Key Attributes: Mixed woodland and linear features suitable for roosting, foraging and commuting pipistrelles. Level of Importance: Local.	Direct Mortality and Habitat Fragmentation	Impact Characterisation: • Extent: Severance of commuting route 24 between Dundas Estate and Dalmeny, will affect bats' ability to fly between roosting and foraging areas, with possible implications for RTA. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Provision of safe crossing including planting hedge and standard trees alongside bus lane to assist commuting bats. Gantry at location approximately 250m east of ch1500 will be utilised as a bat bridge to reconnect CR 24.	Not significant
	Disturbance	Impact Characterisation: • Extent: Road and junction lighting may have a negative effect on commuting bats in the area. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Constant. • Duration: Permanent. • Likelihood of Occurrence: Unlikely. Impact Magnitude: Medium. Impact Significance: Not significant. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Location: Swine Burn. Key Attributes: Hopetoun Fisheries pond, broad-leaved and mixed plantation woodland with good foraging potential; roosts and potential roosts. Level of Importance: Authority area.	Direct Mortality and Habitat Fragmentation	Impact Characterisation: • Extent: Severance of commuting routes at Swine Burn and the B9080 as for Kirkliston, will affect bats' ability to fly between roosting and foraging areas, with possible implications for RTA if bats cannot cross the M9 slip roads safely. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of Occurrence: Certain. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Provision of safe crossing including planting hedge and standard trees alongside Swine Burn and the B9080 to assist commuting bats and deter bats from crossing road.	Not significant
	Disturbance	Impact Characterisation: • Extent: Road and junction lighting onto Swine Burn would represent significant increases in current levels of disturbance along feeding and commuting corridors. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Continuous. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Pollution	Impact Characterisation: • Extent: Potential pollution events on Swine Burn and downstream impacts on Niddry Burn and the River Almond with impacts on prey habitat resource. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single events. • Duration: Short term. • Likelihood of Occurrence: Probable.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Impact Magnitude: Low. Impact Significance: Significant negative impact.		
Location: Carmelhill and Muiriehall and Humbie. Key Attributes: Broad-leaved plantation woodlands with potential tree roosts. Quarry pond provides aquatic foraging resource; good connectivity to high value habitats in adjacent areas. Level of Importance: Carmelhill and Muriehall, Local.; Humbie, Authority area.	Direct Mortality and Habitat Fragmentation	Impact Characterisation: • Extent: Severance of commuting routes at Swine Burn and the B9080 as for Kirkliston, will affect bats' ability to fly between roosting and foraging areas, with possible implications for RTA if bats cannot cross the M9 slip roads safely. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
Location: Kirkliston. Key Attributes: Suburban area with amenity and grassland habitats. River Almond, Niddry Burn and Black Brae Weir provide excellent roosting and foraging; good connectivity to the rest of the study area. Level of Importance: Authority area.	Direct Mortality and Habitat Fragmentation	Impact Characterisation: • Extent: Severance of commuting routes at Swine Burn (ch1700-2100) and the B9080 will affect bats' ability to cross the M9 Link between roosting and foraging areas, with possible implications for RTA if bats cannot cross the M9 Link road safely. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Provision of safe crossing including planting hedge and standard trees alongside Swine Burn and the B9080 to assist commuting bats and deter bats from crossing road.	Not significant
	Disturbance	Impact Characterisation: • Extent: Road and junction lighting onto Niddry Burn and the River Almond would represent significant increases in current levels of disturbance along feeding and commuting corridors. • Effect: Direct negative. • Reversibility: Irreversible.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Frequency: Constant. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.		
Location: Ross's Plantation, Lindsay's Craig and Overton. Key Attributes: Mixed broad-leaved woodland and grassland habitats, Niddry Burn and M9 verges. Level of Importance: Authority area.	Direct mortality and Habitat Fragmentation	Impact Characterisation: • Extent: Small area of tree felling and clearance for construction alongside the M9 will involve felling of mature and semi-mature trees with roost potential. Potential mortality or injury to any bats roosting in trees to be felled. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Niddry Burn culvert dimensions to be at least as wide as the current culvert.	Not significant
	Disturbance	Impact Characterisation: • Extent: Road and junction lighting onto Niddry Burn and the River Almond would represent significant increases in current levels of disturbance along feeding and commuting corridors. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Constant. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation: None. Specific Mitigation: Adherence to light pollution mitigation measures at the Niddry Burn or woodland edges.	Not significant
	Pollution	Impact Characterisation: • Extent: Pollution events along the M9 or M9 Link during operation would potentially affect the foraging habitat resource at the Niddry Burn and	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		River Almond. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Single events. • Duration: Short-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact.		

Table 4.17: Terrestrial Breeding Birds: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - **Ground Nesting Birds: Lapwing ((AL UB LB), skylark (AL, UB & LB), grasshopper warbler (RL & UB), reed bunting (RL, UB & LB) and grey partridge (RL, UB & LB).** **Scrub and Hedgerow Nesting Birds: bullfinch (RL, UB & LB), linnet (RL, UB & LB), willow warbler (AL) and yellowhammer (RL, UB & LB).** **Tree and Woodland Nesting Birds: Goldcrest (AL), great spotted woodpecker (LB), green woodpecker (AL), kestrel (AL) and song thrush (RL, UB & LB).** **Riparian Nesting Birds: Gadwall (AL) and sand martin (AL & LB).** **Other Species: Barn owl (S1, AL & LB), house martin (AL), house sparrow (RL & UB), starling (RL & UB), swallow (AL) and swift (LB).** **Key:S1=WCA 1i. RL=JNCC Red List, AL=JNCC Amber List, UB=UKBAP, LB= LBAP** **Legal Framework: Wildlife and Countryside Act 1981 (as amended) and Nature Conservation (Scotland) Act 2004.** **Figure Reference: Figure 10.6.**				
Location: Operational route corridor comprising the proposed scheme and adjacent habitats. Key Attributes: Ground Nesting: Agricultural fields both arable and pasture, semi-improved grassland. Scrub and Hedgerow:	Direct Mortality	Impact Characterisation: • Extent: Operational road corridor. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Recurring. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Implication: It is an offence under the Wildlife and Countryside Act 1981 and Nature Conservation (Scotland) Act 2004 to intentionally or	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Areas of scattered and continuous scrub, newly planted woodland <5m height, tall ruderal vegetation and hedgerows. Trees and Woodland: Scattered trees, hedgerow standards and mature woodland (plantation and semi-natural). Riparian: Riparian habitat. Level of Importance: Authority area.		recklessly kill, injure or take any wild bird; take, damage or destroy the nest of any wild bird while it is in use or being built; and take or destroy the egg of any wild bird.		
	Habitat Loss	Impact Characterisation: • Extent: Footprint of proposed scheme (refer to Terrestrial Habitats for estimates of habitat loss). • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Implication: As detailed above.	Generic Mitigation (Table 3.2). Specific habitat creation (terrestrial habitats).	Not significant
	Disturbance	Impact Characterisation: • Extent: Operational route corridor. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Recurring. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact. Not significant for ground nesting, tree and woodland and riparian nesting birds.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Operational route corridor. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Constant. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
	Pollution	Impact Characterisation: • Extent: Variable depending on dispersal and type of pollution. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Unlikely. Impact Magnitude: Low. Impact Significance: Significant negative impact for ground nesting and riparian nesting birds. Legal Implication: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
Location: St. Margaret's Marsh SSSI. Key Attributes: Assemblage of breeding bird territories including reed bunting, water rail and willow warbler. Level of Importance: Authority area.	Direct Mortality	Impact Characterisation: • Extent: Footprint of proposed scheme. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Implication: As detailed above.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Loss	Impact Characterisation: • Extent: Footprint of proposed scheme (refer to Terrestrial Habitats for estimates of habitat loss). • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Implication: As detailed above.	Generic Mitigation (Table 3.2). Specific habitat creation (terrestrial habitats).	Not significant
	Disturbance	Impact Characterisation:	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Extent: Operational route corridor. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Implication: As detailed above.		
	Pollution	Impact Characterisation: • Extent: Variable depending on dispersal and type of pollution. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact. Legal Implication: As detailed above.	Generic Mitigation (Table 3.2).	Not significant

Table 4.18: Terrestrial Wintering Birds: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - **Tree & Woodland: Goldcrest (AL), great spotted woodpecker (LB) and song thrush (RL, UB & LB).** **Scrub & Hedgerow: Bullfinch (RL, UB & LB), house sparrow (UB & RL), starling (UB & RL), fieldfare (S1, LB), redwing (S1, AL) and yellowhammer (UB & RL).** **Arable/Grassland: Lapwing (AL, UB & LB), curlew (AL, UB & LB), kestrel (AL), grey partridge (UB, LB & RL), linnet (RL & LB) and skylark (RL, UB & LB)** **Wetland & watercourse: Cormorant, reed bunting (RL, UB & LB), common snipe (AL & LB), mallard, and greylag goose (A1, S1 & AL).** **Key: A1=Annex 1 species, S1=WCA 1i. RL=JNCC Red List, AL=JNCC Amber List, UB=UKBAP, LB=LBAP** **Legal Protection: Wildlife and Countryside Act 1981 (as amended) and Nature Conservation (Scotland) Act 2004** **Figure Reference: Figure 10.6.**				
Impacts and mitigation as for Terrestrial Breeding Birds (Table A10.7.19). **Key attributes are presented in Table A10.7.19.**				

Table 4.19: Otter: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - Otter are propriety species in the UK BAP UK, and are listed as an LBAP species in Fife and the City of Edinburgh. **Legal Framework: Habitats Directive 1992 (Annex IV), Conservation (Natural Habitats & c) Regulations 1994 and Nature Conservation (Scotland) Act 2004.** **Figure Reference: Confidential Figure 3.**				
Location: Coast - Rosyth Europarc - North Queensferry Key attribute: Important coastal area. St. Margaret's Marsh has extensive undisturbed area of reeds suitable for breeding; St. Margaret's Marsh provides excellent lying up potential. Small pools provide washing sites.	Direct Mortality	Impact Characterisation: • Extent: Risk of road traffic accidents (RTA) involving otters on the B981 realignment where it is at-grade in St. Margaret's Marsh. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Recurring. • Duration: Permanent. • Likelihood of Occurrence: Likely. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: It is an offence under the above legislation to intentionally or recklessly capture, injure or kill an otter.	Generic Mitigation (Table 3.2). Specific Mitigation: Otter fencing will be provided along the proposed scheme in St. Margaret's Marsh. Fencing will be positioned in such a way that otters will be directed to safe crossing point at the Inverkeithing - Rosyth railway overbridge.	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Level of Importance: Authority area.				
Locations: Swine Burn Niddry Burn River Almond Key Attributes: Core area of otter activity with abundant lying up sites and high value foraging and commuting habitat. Level of Importance: Authority area.	Direct Mortality	Impact Characterisation: • Extent: Risk of increased road traffic accidents (RTA) of otter on the new road sections and realignments. Risk of otters drowning in culverts. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single/recurring. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: High. Impact Significance: Significant negative impact. Legal Framework: As detailed above.	Generic Mitigation (Table 3.2). Specific Mitigation: Otter proof fencing will be erected along the M9 Junction 1A to 150m east of the River Almond and 150m west of Niddry Burn along the M9 (ch300-2700), and 150m north of Swine Burn along the link road. This will prevent otters from finding their way onto the carriageway. Swine Burn will be culverted at ch1850 where the proposed scheme crosses the watercourse. This culvert will include integral mammal ledges which will enable otters to continue to commute along the Swine Burn corridor. The potential increased risk of blockage at all culverts will be mitigated through implementation of a regular inspection programme.	Not significant
	Habitat Loss	Impact Characterisation: • Extent: Loss of suitable foraging habitat for otter along Niddry Burn and Swine Burn as a result of road widening, junction improvements, watercourse realignment and culverting. Loss of adjacent woodland/scrub habitats near the Niddry Burn and along the Swine Burn. Loss of holt on the Niddry Burn due to new drainage systems. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2). Specific Mitigation: Riparian habitat planting along Niddry Burn and Swine Burn to offset the loss of wetland and riparian habitat. An artificial holt will be created further to the west along the Niddry Burn.	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Severance of home ranges, commuting routes and dispersal routes of otter due to creation of a culvert on the Swine Burn. Lengthening of	Generic Mitigation (Table 3.2). Specific Mitigation:	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Niddry Burn culvert under M9 (ch1100) may reduce its suitability for otter to move between habitat areas. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Above mitigation for prevention of direct mortality including provision of mammal ledges and fencing to direct mammals to safe crossing points will reduce the impacts of severance along Swine Burn and Niddry Burn.	
	Pollution	Impact Characterisation: • Extent: Accidental spills and polluted run-off from road are unlikely to represent significant changes from current levels. • Effect: Indirect and direct negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short to medium-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant

Table 4.20: Amphibians: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - Common frog is a Fife Council LBAP species. Common toad is a Fife and Edinburgh City Council LBAP species. **Legal Framework: Wildlife and Countryside Act 1981 (as amended) and Nature Conservation (Scotland) Act 2004.** **For great crested newt: Habitats Directive 1992 (Annex IV), Conservation (Natural Habitats & c) Regulations 1994 and Nature Conservation (Scotland) Act 2004.** **Figure Reference: Figure 10.9.**				
Location: Suitable terrestrial habitats throughout the proposed scheme including habitats at NT 11300 78700 and NT 114 779. Key Attributes: Assemblages of common amphibian species comprising common frog, common toad, smooth and palmate newt. Level of Importance: Local.	Direct Mortality	Impact Characterisation: • Extent: Along the length of the proposed scheme adjacent to suitable habitats. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: High. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Loss	Impact Characterisation: • Extent: Habitat loss to proposed scheme (refer to Terrestrial Habitats). • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant.
	Habitat Fragmentation	Impact Characterisation: • Extent: Length of the proposed scheme between Port Edgar Barracks and South Queensferry at the start of the A9 Spur (ch1500-4400). • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain.	Generic Mitigation (Table 3.2). Specific Mitigation: Mitigation proposals to offset potential impacts on other ecological receptors is likely to mitigate for fragmentation and severance on amphibians. This will be through compensatory planting and landscaping of road verges and additional habitat creation areas. Underpasses provided for badgers and otters (see badger and otter sections) should also allow reduce fragmentation of habitat used	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Impact Magnitude: Medium. Impact Significance: Significant negative impact.	by amphibians.	

Table 4.21: Terrestrial Invertebrates: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation Status - Red Data Book (RDB3) (1 species), Notable (9 species), Scottish Biodiversity List (12 species), Local Biodiversity Action Plan (12 species). All location sites are illustrated on: Figure 10.9				
Receptor: Terrestrial Invertebrates. Locations: 1 - St. Margaret's Hope Wood and St. Margaret's Marsh SSSI; 2 - Ferry Hills SSSI; 3 - Dundas Wood North; 4 - Dolphington Burn Wood; 5 - Ross's Plantation; 6 - Parkland, West Kirkliston; and 7 - Lindsay's Craigs; Key Attributes: Mosaic of habitats including; woodlands, dead wood, scrub, grasslands, waterbodies and wetlands. Level of Importance: Local	Habitat Loss	Impact Characterisation: • Extent: Direct loss of: poor semi-improved grassland habitat including areas at site 2; improved grassland habitat including areas at site 2; woodland habitat including areas at sites 1, 3, 4, 5, 6 and 7. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2). Specific Mitigation: In collaboration with stakeholders, a management plan will be produced to enhance habitats at St. Margaret's Marsh. New woodland will be created on the Dundas Estate at ch2650-2800 and at Castlandhill.	Not significant
Receptor: Terrestrial Invertebrates. Locations: 2 - Ferry Hill SSSI;	Habitat Fragmentation	Impact Characterisation: • Extent: Two small areas of woodland would be fragmented by the proposed scheme at sites 3 and 4. • One area of semi-improved/acid grassland would be fragmented by the	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
3 - Dundas Wood North; and 4 - Dolphington Burn Wood; Key Attributes: Mosaic of habitats including; woodlands, dead wood, scrub, grasslands, waterbodies and wetlands. Level of Importance: Local.		proposed scheme at site 2. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact.		
Receptor: Terrestrial Invertebrates. Locations: 1 - St. Margaret's Hope Wood and St. Margaret's Marsh SSSI; 2 - Ferry Hills SSSI; 3 - Dundas Wood North; 4 - Dolphington Burn Wood; 5 - Ross's Plantation; 6 - Parkland, West Kirkliston; and 7 - Lindsay's Craigs. Key Attributes: Mosaic of habitats including; woodlands, dead wood, scrub, grasslands, waterbodies and wetlands. Level of Importance: Local.	Direct Mortality	Impact Characterisation: • Extent: Direct loss of: poor semi-improved grassland habitat including areas at site 2; improved grassland habitat including areas at site 2; woodland habitat including areas at sites 1, 3, 4, 6, and 7. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
Receptor: Terrestrial Invertebrates. Locations: 1 - St. Margaret's Hope Wood and St. Margaret's	Disturbance	Impact Characterisation: • Extent: Disturbance may arise in areas of direct habitat loss including: poor semi-improved grassland habitat including areas at site 2; improved grassland habitat including areas at site 2; woodland habitat including areas at sites 1, 3, 4, 5 and 6.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Marsh SSSI; 2 - Ferry Hills SSSI; 3 - Dundas Wood North; 4 - Dolphington Burn Wood; 5 - Ross's Plantation; and 6 - Parkland West Kirkliston; Key Attributes: Mosaic of habitats including; woodlands, dead wood, scrub, grasslands, waterbodies and wetlands. Level of Importance: Local.		• Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring event. • Duration: Short term. • Likelihood of occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.		
Receptor: Terrestrial Invertebrates. Locations: Throughout the full extent of the proposed scheme alongside the vegetated banks associated with road, junctions and viaduct, within the road footprint. Key Attributes: Mosaic of habitats including; woodlands, dead wood, scrub, grasslands, waterbodies and wetlands. Level of Importance: Local.	Pollution	Impact Characterisation: • Extent: Throughout the length of the proposed scheme alongside the vegetated banks associated with road, junctions and viaduct. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Recurring event. • Duration: Permanent. • Likelihood of occurrence: Probable. Impact magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant

Table 4.22: River Habitat: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Figure Reference: Figure 10.11.				
Location: Swine Burn (JA08 JA09) Niddry Burn (JA12) River Almond (JA14) Key Attributes: In-channel and riparian habitat. Level of Importance: Authority area (Swine Burn JA09, River Almond JA14). Local (Swine Burn JA08, Niddry Burn JA12).	Habitat Loss	Impact Characterisation: • Extent: Swine Burn, Niddry Burn. Localised direct loss of habitat within the proposed scheme footprint. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2). Swine Burn: the realignment of this burn will include meanders and bends as part of the design together with additional riparian planting (as detailed under Terrestrial Habitats - Operation).	Not significant. Swine Burn realignment: significant positive impact (habitat loss) of medium magnitude
	Habitat Fragmentation	Impact Characterisation: • Extent: Swine Burn and Niddry Burn. Potential fragmentation of in-channel and riparian habitat. Culvert would prevent upstream migration of aquatic macroinvertebrates and realignments would inhibit upstream migration of invertebrates. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Changes to Hydrology	Impact Characterisation: • Extent: Swine Burn and Niddry Burn. Potential alteration to hydrology affecting in-channel and riparian habitat. Effects on flow related to structures would be local within the vicinity of the culvert and/or realignment sections with the potential for migration or scour or deposition. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Constant. • Duration: Permanent.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		• Likelihood of Occurrence: Probable. Impact Magnitude: Moderate. Impact Significance: Significant negative impact.		
	Water Pollution	Impact Characterisation: • Extent: Swine Burn, Niddry Burn, River Almond. Potential for considerable downstream impacts from road run-off and accidental spills e.g. RTA's. Not just localised but continuing downstream. • Effect: Direct negative. • Reversibility: Reversible. • Frequency: Constant (road); Single event (traffic accident spillage). • Duration: Permanent (road run-off); Short to medium-term (traffic accident spillage). • Likelihood of Occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant

Table 4.23: Aquatic Macroinvertebrates: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Legal Framework: Water Framework Directive (European Directive 2000/60/EC). **Figure Reference: Figure 10.11.**				
Location: JA01 Brankholm Burn JA02 Unnamed tributary JA03 Unnamed pond JA04 Linn Mill Burn JA05/06 Dolphington Burn JA08/09 Swine Burn JA10/11/13 Niddry Burn JA14 River Almond.	Habitat Loss and Shading	Impact Characterisation: • Extent: Swine Burn, Niddry Burn. Localised direct loss of habitat within the proposed scheme footprint. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2). No specific mitigation is proposed for shading. Swine Burn: the realignment of this burn will include meanders and bends as part of the design together with additional riparian planting (as detailed under Terrestrial Habitats - Operation).	Not significant. Swine Burn realignment: significant positive impact (habitat loss) of medium magnitude.

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Key Attribute/s: Aquatic macroinvertebrate community and biological water quality. Level of Importance: Regional: Niddry Burn. Authority area: Unnamed pond, Swine Burn, River Almond. Local: Brankholm Burn, Estuarine tributary, Linn Mill Burn, Dolphington Burn.	Habitat Fragmentation	Impact Characterisation: • Extent: Swine Burn, Niddry Burn. Culvert would prevent upstream migration of aquatic macroinvertebrates and realignments would inhibit upstream passage of invertebrates. • Effect: Indirect negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Changes to Hydrology	Impact Characterisation: • Extent: Swine Burn, Niddry Burn. Localised in vicinity of culvert and/or realigned sections initially, with potential for migration/deposition of scour. • Effect: Indirect negative. • Reversibility: Reversible. • Frequency: Recurring. • Duration: Permanent. • Likelihood of Occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Water Pollution/ Sedimentation	Impact Characterisation: • Extent: Swine Burn, Niddry Burn, River Almond. Potential for considerable downstream impacts from road run-off and accidental spills through RTAs. Not just localised, but continuing downstream. • Effect: Direct and indirect negative. • Reversibility: Reversible in time. • Frequency: Single event. • Duration: Medium-term. • Likelihood of Occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant negative impact. Legal Framework: Notable pollution events are an offence under the Environment Protection Act 1990.	Generic Mitigation (Table 3.2).	Not significant

Table 4.24: Freshwater Macrophytes: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Legal Framework: Water Framework Directive (European Directive 2000/60/EC). **Figure Reference: Figure 10.11.**				
Location: JA01 Brankholm Burn JA04 Linn Mill Burn JA06 Dolphington Burn JA07 Humbie Reservoir JA08/09 Swine Burn JA10/12/13 Niddry Burn JA14 River Almond Key Attributes: Attributes required for a diverse macrophyte community are wet habitat, varying degrees of flow/ water level, varying degrees of shade, varying degrees of water quality. Level of Importance: Local for all sites.	Habitat Loss and Shading	Impact Characterisation: • Extent: Swine Burn (JA11), Niddry Burn. Direct loss of aquatic habitat within the footprint of the proposed scheme. • Effect: Direct negative. • Reversibility: Irreversible within footprint of new culvert or culvert extension only (through shading). • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Certain. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2). No specific mitigation is proposed for shading. Swine Burn: the realignment of this burn will include meanders and bends as part of the design together with additional riparian planting (as detailed under Terrestrial Habitats - Operation).	Not significant. Swine Burn realignment: significant positive impact (habitat loss) of medium magnitude.
	Pollution	Impact Characterisation: • Extent: Linn Mill Burn (JA04), Swine Burn (JA09), Niddry Burn (JA13) and River Almond (JA14) within footprint of the proposed scheme. • Effect: Direct/Indirect negative. • Reversibility: Reversible. • Frequency: Single event. • Duration: Short-term. • Likelihood of occurrence: Probable (Unlikely for Linn Mill Burn). Impact Magnitude: Low. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Changes in Hydrology	Impact Characterisation: • Extent: Swine Burn (JA09), Niddry Burn. • Effect: Indirect negative as in channel habitats will be altered by changing flow patterns (scour and deposition). • Reversibility: Reversible. • Frequency: Recurring. • Duration: Short-term. • Likelihood of occurrence: Probable.	Generic Mitigation (Table 3.2).	Not significant

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Impact Magnitude: Low. Impact Significance: Significant negative impact.		

Table 4.25: Freshwater Fish: Specific Impacts, Mitigation and Residual Impacts - Operation

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
Background Information: Conservation and Legal Status - All freshwater fish species are protected under the Salmon and Freshwater Fisheries Act (2003), Atlantic salmon and bullhead are EC Habitats Directive Annex II listed. Sea lamprey, river lamprey and brook lamprey are EC Habitats Directive Annex II & V listed. Brown trout and European eel are species of conservation concern in the UK BAP and have a significant commercial importance. Atlantic salmon, brown trout, European eel, sea trout and river lamprey, have LSAPs for the City of Edinburgh. **Legal Framework: EC Freshwater Fish Directive (2006/44/EC); Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act (2003); and Conservation (Natural Habitats & c.) Regulations (1994).** **Figure Reference: Figure 10.11**.				
Location: Swine Burn JA09 Swine Burn JA08. Niddry Burn JA12 Proposed extension of an existing culvert. River Almond JA14 Key Attribute(s): Fish species (brown trout, bullhead, minnow, three-spined stickleback) and the heterogeneous habitat needed to support the existing fish communities. Level of Importance: Authority area: Swine Burn (JA08) Regional: Swine Burn (JA09), Niddry Burn, River Almond.	Road Run-off	Impact Characterisation: • Extent: Swine Burn (JA09). Niddry Burn, River Almond. Potential for negative impacts at site and further downstream (not localised) through road run-off, accidental spills and RTA's. • Effect: Direct/Indirect negative. • Reversibility: Reversible. • Frequency: Constant. • Duration: Permanent. • Likelihood of occurrence: Certain (Probable for acute pollution events). Impact Magnitude: High. Impact Significance: Significant negative impact.	Generic Mitigation (see Table 3.2).	Not significant
	Habitat Loss	Impact Characterisation: • Extent: Swine Burn (JA09), Niddry Burn. Limited to the length of watercourse containing a culvert and/or bridge footings. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Single event. • Duration: Permanent. • Likelihood of occurrence: Certain. • Significance: Significant negative impact.	Generic Mitigation (Table 3.2). Swine Burn: the realignment of this burn will include meanders and bends as part of the design together with additional riparian planting (as detailed under Terrestrial Habitats - Operation).	Not significant. Swine Burn realignment: significant positive impact (habitat loss) of medium magnitude

Location and Key Attribute	Potential Impact	Characterisation of Impact (pre-mitigation)	Proposed Mitigation	Significance of Residual Impact (post-mitigation)
		Impact Magnitude: Medium. Impact Significance: Significant negative impact.		
	Artificial Lighting	Impact Characterisation: • Extent: Swine Burn (JA09). Limited to areas of watercourse in the immediate vicinity to culverts. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Constant. • Duration: Permanent. • Likelihood of occurrence: Probable. Impact Magnitude: Low/Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Habitat Fragmentation	Impact Characterisation: • Extent: Swine Burn (JA09) and Niddry Burn. Culverts would inhibit the free passage of fish and would lead to the loss of upstream habitat to those fish unable to pass the culvert. • Effect: Direct negative. • Reversibility: Irreversible. • Frequency: Recurring. • Duration: Permanent. • Likelihood of occurrence: Probable. Impact Magnitude: Medium. Impact Significance: Significant negative impact.	Generic Mitigation (Table 3.2).	Not significant
	Shading	Impact Characterisation: • Extent: Swine Burn new culvert and culvert extension and Niddry Burn culvert extension. Culverts may offer increased cover for fish. • Effect: Indirect positive. • Reversibility: Irreversible • Frequency: Recurring. • Duration: Permanent. • Likelihood of occurrence: Probable. Impact Magnitude: Low. Impact Significance: Significant positive impact.	No Mitigation proposed.	Significant positive impact of low magnitude.

5. References

Alabaster, J. S. and Lloyd, R. (1982). Water Quality Criteria for Freshwater Fish. Butterworths pp 297.

Bach, L. and Limpens, H. (2004). Tunnels as a Possibility to Connect Bat Habitats. Mammalia, 68, 411-420.

Bat Conservation Trust (2008). Bats and lighting in the UK. Available at: http://www.bats.org.uk/pages/bats_and_lighting.html [Accessed June 2008 - March 2009].

Bern Convention (1979). Appendix II, strictly protected fauna species.

Bregman, J.I. and Edell, R.D. (2001). Environmental compliance handbook. Second Edition. Lewis Publishers/CRC Press, Taylor & Francis Group.

Brinkmann, R., Bach, L., Biedermann, M., Dietz, M., Dense, C., Fielder, W., Fuhrmann, M., Kiefer, A. Limper, H., Niermann, I., Schorcht, W., Rahmel, U., Reiter, G., Simon, M., Steck, C. and Zahn, A. (2003). Crossing Points for Bats - limiting damage in habitat fragmentation by transport projects. Position Paper of the Wildlife Points Working Party. Available at: http://www.buero-brinkmann.de [Accessed June 2008 - March 2009].

British Standards Institute (1991). BS 5837:1991, Guide for Trees in Relation to Construction. British Standards Institute, London, UK.

British Standards Institute (1992). BS 5489 - Road lighting.

Buchan, B.W. (1993). Effects of Enhanced Lighting on the Behaviour of Nocturnal Frogs. Animal Behaviour 45, (5), 893-899.

Burton, N.H.K., Armitage, M.J.S., Musgrove, A.J. and Rehfisch, M.M. (2002). Environmental Assessment: Impacts of Man-Made Landscape Features on Numbers of Estuarine Waterbirds at Low Tide. Environmental Management, 30 (6), 857-864.

Conservation (Natural Habitats, & c.) Regulations (1994) (as amended). Available at: http://opsi.gov.uk/si/si1994/uksi_19942716_en_1.htm [Accessed June 2008 - March 2009]

Cowan, A (2003). Trees and Bats. Arboricultural Association Guidance Note 1 (Second Edition). Arboricultural Association, Hanks.

Edinburgh Biodiversity Action Plan 2004 - 2009. Available at: http://www.edinburgh.gov.uk/internet/Environment/Land_and_premises/Natural_heritage/CEC_biodiversity_action_plan_2004_-_2009 [Accessed June 2008 - March 2009].

English Nature (1996). English Nature Research Report No. 62. English Nature, Peterborough.

English Nature (2001). Great Crested Newt Mitigation Guidelines. English Nature, Peterborough.

Entwistle, A.C., Harris, S., Hutson, A.M., Racey, P.A., Walsh, A., Gibson, S.D., Hepburn, I. and Johnston, J. (2001) Habitat Management for Bats; A guide for Land Managers, Land Owners and their Advisors. Joint Nature Conservation Committee, Peterborough.

Environment Agency. Available at: http://www.environment-agency.gov.uk/yourenv/eff/pollution [Accessed June 2008 - March 2009].

Environmental Impact Assessment (Scotland) Regulations (1999), Schedule 4, Part 1. Available at: http://www.opsi.gov.uk/legislation/scotland/ssi1999/99900107.htm#sch3 [Accessed June 2008 - March 2009].

Environment Protection Act (1990) (c. 43). Available at: http://www.opsi.gov.uk/acts/acts1990/Ukpga_19900043_en_1.htm [Accessed June 2008 - March 2009].

European Commission (1992). Council Directive (92/43/EEC) on the Conservation of natural habitats and wild flora and fauna (Habitats Directive). Available at: http://www.eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0043:EN:HTML [Accessed June 2008 - March 2009].

European Commission (2000). Water Framework Directive (2000/60/EC). Available at: http://www.defra.gov.uk/environment/water/wfd [Accessed June 2008 - March 2009].

European Commission (2006). Freshwater Fish Directive (2006/44/EC). Available at: http://www.defra.gov.uk/environment/water/quality/fwfish/index.htm [Accessed June 2008 - March 2009].

European Inland Fisheries Advisory Commission. Available at: http://www.fao.org/fi/website/FI/RetrieveAction.do?dom=org&xml+eifac_inst.xml [Accessed June 2008 - March 2009].

Farner, D. S. (1964). The Photoperiodic Control of Reproductive Cycles in Birds. American Scientist 52, 137-156.

Fife Council (2008). Fife Biodiversity Action Plan.
Available at: http://www.ukbap.org.uk/lbap.aspx?id=391 [Accessed June 2008 - March 2009].

Green, R. and Green, J. (1997). Otter Survey of Scotland 1991-94. The Vincent Wildlife Trust, London.

Grogan, A., Philcox, C. and Macdonald, D. (2001) Nature Conservation and Roads: Advice in Relation to Otters. WILDCRU, Oxford.

Highways Agency et al. (1993). DMRB Volume 10 {Environmental Design}., Section 4, Parts 1-4, 6-7. Highways Agency, Scottish Executive Development Department, The National Assembly for Wales and the Department of Regional Development Northern Ireland.

Haskell, D.G. (2000). Effects of forest roads on macro-invertebrate soil fauna of the southern Appalachian Mountains. Conservation Biology, 14 (1) 57-63.

Hill, D. (1992). The impact of noise and artificial light on waterfowl behaviour: a review and synthesis of available literature. British Trust for Ornithology Research Report No. 61.

Hill, M. O. (1996). Tablefit version 1.0, for identification of vegetation types. Institute of Terrestrial Ecology, Huntingdon.

Hollifield, B.K. and R.W. Dimmick. (1995). Arthropod abundance relative to forest management practices benefiting ruffed grouse in the southern Appalachians. Wildlife Society Bulletin 23, 4, 756-764.

IEEM (2006). Guidelines for Ecological Impact Assessment in the United Kingdom.

Institute of Lighting Engineers
Available at: http://www.ile.org.uk/lighting_technical.htm [Accessed June 2008 - March 2009].

IUCN (2001). Red Data 2001.
Available at: www.redlist.org/search/search-basic.hmtl [Accessed June 2008 - March 2009].

Iuell, B., Bekker, G. J., Cuperus, R., Dufek, J., Fry, G., Hicks, C., Hlaváč, V., Keller, V. B., Rosell, C., Sangwine, T., Tørsløv, N., Wandall, B. and le Maire, B. (ed.) (2003). Wildlife and traffic: a European handbook for identifying conflicts and designing solutions. COST 341. KNNV Publishers.

Kruuk, H. (1995). Wild Otters, Predation and Populations. Oxford University Press, Oxford.

Kruuk, H. (2006). Otters Ecology and Conservation. Oxford University Press, Oxford.

Kunz, T. (1982). The Ecology of Bats. Plenum Press, New York.

Limpens, H.J.G.A. and Kapetyn, K. (1991). Bats, Their Behaviour And Linear Landscape Elements Myotis, 29, 39 - 48.

Limpens, H.J.G.A., Twisk, P. and Veenbass, G. (2005). Bats and road construction. Rijkswaterstaat, Netherlands.

Lofts, D., and Merton, G. (1968). Photoperiodic and Physiological Adaptations Regulating Avian Breeding Cycles and their Ecological Significance Journal of Zoological Society of London 155,327-394.

Mader, H-J. (1984). Animal habitat isolation by roads and agricultural fields. Biological Conservation, 29, 81-96.

Madsen, T., Stille. B, and Shine, R. (1996). Inbreeding Depression in an Isolated Population of Adders Vipera berus. Biological Conservation. 75, 113-118.

Mineau, P. and Brownlee, L.J. (2005). Road salts and birds: an assessment of the risk with particular emphasis on winter finch mortality. Wildlife Society Bulletin. 33(3) 835-841.

Mitchell-Jones, A.J. and McLeish, A.P. (1999). The Bat Worker's Manual. JNCC, Peterborough.

Morris, M.G. (2000). The effects of structure and its dynamics on the ecology and conservation of arthropods in British grasslands. Biological Conservation, 95,129-142.

National Roads Authority of Ireland (2005). Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes. NRA, Dublin.

Nature Conservation (Scotland) Act (2004). Available at:
http://www.opsi.gov.uk/legislation/scotland/acts2004/asp_20040006_en_1 [Accessed June 2008 - March 2009].

Noss, R. (1995). The Ecological Effects of Roads, or, The Road to Destruction. The Road Rippers Handbook, Wildlands Center for Preventing Roads, Missoula, MT.

Neal, E. and Cheeseman, C. (1996). Badgers. T. & A. D. Poyser Ltd, London.

NPPG 14 Natural Heritage, Paragraph 74. Available at:
http://www.scotland.gov.uk/Publications/1999/01/nppg14 [Accessed June 2008 - March 2009]

Outen, A.R. (undated). The Possible Ecological Implications of Artificial Lighting. Hertfordshire Environmental Records Centre.

Oxley, D.J. and Fenton, M.B. (1976). The harm our roads do to nature and wildlife. Canadian Geographic Journal. 92, 40-45.

Philcox, C.K., Grogan, A.L. and Macdonald, D.W. (1999). Patterns of Otter *Lutra lutra* Road Mortality in Britain. Journal of Applied Ecology 36, 748-762.

Protection of Badgers Act (1992). (c. 51). Available at: http://www.opsi.gov.uk/ACTS/acts1992/ukpga_19920051_en_1 [Accessed June 2008 - March 2009].

Racey, P.A. and Speakman, J.R. (1987). The energy costs of pregnancy and lactation in heterothermic bats. Symposia of the Zoological Society of London. 54, 107-125.

Rawson, H.E.A. (1923). Bird's Song in Relation to Light. Transactions of the Hertfordshire Natural History Society. 17, 363-365.

Rydell, J. and Racey, P.A. (1993). Street lamps and the feeding ecology of insectivorous bats. Recent Advances in Bat Biology. Zoological Society of London Symposium abstracts.

Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act (2003). Available at: http://www.opsi.gov.uk/legislation/scotland/acts2003/20030015.htm [Accessed June 2008 - March 2009].

Scottish Biodiversity List. Available at: http://www.biodiversityscotland.gov.uk/pageType2.php?id=35&type=2&navID=92 [Accessed June 2008 - March 2009]

SEPA (2003). Pollution Prevention Guidelines. Available at: http://www.environment-agency.gov.uk/netregs/links/63901.aspx [Accessed June 2008 - March 2009].

Slabbekoorn, H. and Ripmeester, E.A.P. (2008). Birdsong and anthropogenic noise: implications and applications for conservation. Molecular Ecology. 17(1) 72-83.

Slater, F. (1994). Wildlife Road Casualties. British Wildlife 5 (4) 214 - 221.

Scottish Natural Heritage (Undated). Otters and Development. Scottish Wildlife Series. . Available at: http://www.snh.org.uk/publications/on-line/wildlife/otters/default.asp [Accessed 14/11/08]

Scottish Natural Heritage (2001). Scotland's Wildlife: Badgers and Development.

Scottish Natural Heritage (2005). A Handbook on Environmental Impact Assessment. Available at: http://www.snh.org.uk/wwo/sharinggoodpractice/eia_home.asp [Accessed June 2008 - March 2009].

Strachan, R. (1998). Water Vole Conservation Handbook. Environment Agency, English Nature, WildCRU. Oxford, UK.

Strachan, R. and Moorhouse, T. (2006). Water Vole Conservation Handbook. (2nd ed.) Wildlife Conservation Research Unit, University of Oxford, Oxford, UK.

Transport Scotland (2008). Scottish Transport Appraisal Guidance (STAG) Environment Section - Paragraph 7.4.6. Available at: http://www.transportscotland.gov.uk/files/STAG_Technical_Database_Section_7_May_2008.pdf [Accessed June 2008 - March 2009].

Turnpenny, A.W.H., Clough, S.C., Holden, S.D.J., Bridges, M., Bird, H., O'Keeffe, N., Johnson, D., Edmonds, M. and Hinks, C. (2004). Thames Tideway Strategy: experimental studies on the dissolved oxygen requirements of fish. Babtie Aquatic Contractors report to the Thames Tideway Strategy Group, Report No. FCR 374/04, April 2004.

Walsh, A. and Harris, S. (1996a). Feeding Habitat Preferences of Vespertilionid Bats in Britain. Journal of Applied Ecology, 33, 508-518.

Walsh, A. and Harris, S. (1996b). Factors Determining the Abundance of Vespertilionid Bats in Britain: Geographical, Land Class and Local Habitat Relationships. Journal of Applied Ecology, 33, 519-529.

WebTAG - Biodiversity Sub-Objective TAG Unit 3.3.10. Available at: http://www.webtag.org.uk/webdocuments/3_Expert/3_Environment_Objective?3.3.10.htm [Accessed June 2008 - March 2009].

West Lothian Biodiversity Action Plan. Available at: http://www.ukbap.org.uk/lbap.aspx?ID=489 [Accessed June 2008 - March 2009].

WildCRU, Oxford University (2004). Water Vole Surveys in Fife and Central Cairngorms. SNH commissioned report No. 058.

Wildlife and Countryside Act (1981). (as amended). HMSO, London.