



Tay Road Bridge Joint Board

TAY ROAD BRIDGE RESURFACING

Shadow Habitat Regulations Appraisal Report





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1 INTRODUCTION

The Tay Road Bridge carries the A92 road across the Firth of Tay between Dundee on the north side of the estuary and Newport-on-Tay, Fife on the south side (Appendix A - Error! Reference source not found.1). It is a 2,250 m long structure with a composite twin box girder and reinforced concrete deck. The bridge is 9.75 m above sea-level at the Dundee side and 38.1 m above sea-level in Fife.

The existing surfacing on the bridge structure is the original from 1966 and therefore at least 57 years old and investigations have determined that the surfacing is now at the end of its serviceable life and degrading at an increased rate therefore the bridge should be provided with a new carriageway surfacing. Additionally a review of the existing maintenance record information identified that the majority of the expansion joints are more than 30 years old and starting to fail at an increasing rate, therefore all expansion joints would need to be replaced as part of the proposed works to resurface the Tay Road Bridge. The proposed works will include improvements such as waterproofing of the concrete deck to prolong the serviceable life of the bridge deck.

An underdeck survey was carried out in April 2021, which identified a number of defects to the reinforced concrete soffit associated with the historic ingress of water through defective expansion joints on the deck above. Therefore, it was decided to utilise the carriageway closures for the resurfacing works to gain access to the bridge deck cantilevers and undertake the necessary repairs. The Tay Road Bridge Joint Board (the Client) is currently planning the above improvement works to the full extent of the Tay Road Bridge ('the Proposed Development').

Part of the Firth of Tay is designated as Special Protection Areas (SPA), as a Ramsar wetland and as a Special Areas of Conservation (SAC) (see **Section 1.2, Table 1** for details). Several parts of the firth are within a Site of Special Scientific Interest (SSSI). The Firth of Tay is noted for its extensive sand and mudflats and population of harbour seals and wintering birds.

WSP was commissioned by the Client to undertake a Habitats Regulations Appraisal (HRA) screening assessment of the Proposed Development. The screening assessment (WSP, 2022) determined that the Proposed Development alone has the potential to result in likely significant effects (LSEs) on the qualifying interests of:

- The Firth of Tay and Eden Estuary SAC;
- The Firth of Tay and Eden Estuary SPA; and
- The Outer Forth and St Andrews Bay Complex SPA.

As potential LSE have been identified during this Stage 1: Screening process, a Stage 2: Appropriate Assessment (AA) is required and this shadow HRA (Appropriate Assessment) provides the additional information needed to undertake the AA.

1.1 HRA process

The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended – the Habitats Regulations) place a duty upon ‘Competent Authorities’¹, to consider the potential for effects upon European sites² prior to granting consent for projects or plans. Should Likely Significant Effects (LSE) be identified by the initial screening process it is necessary to further consider the effects by way of an ‘Appropriate Assessment (AA)’. Overall, this process of assessment is known as HRA and further details of the applicable legislative context have been reported in the HRA Screening Report

Guidance on the Habitats Directive (European Commission, 2000a) sets out a step-wise approach which should be followed to enable Competent Authorities to discharge their duties under the Habitats Directive and provides further clarity on the interpretation of Articles 6 (3) and 6 (4). Post-Brexit the process followed in the UK can be summarised as follows (see UK Government, 2021):

- Stage 1: Screening: to check if the proposal is likely to have a significant effect on the site’s conservation objectives;
- Stage 2: Appropriate Assessment: to assess the likely significant effects of the proposal in more detail and identify ways to avoid or minimise any effects; and;
- Stage 3: to consider if proposals that would have an adverse effect on a European site qualify for an exemption.

The assessment only proceeds to Stage 3 if significant adverse effects on site integrity either as a result of the Proposed Development alone or in-combination with other plans or projects cannot be ruled out, despite consideration of appropriate mitigation measures and in light of the site’s conservation objectives.

1.2 Summary of HRA screening

Stage 1 of the HRA process was completed in 2022 and identified potential for effects on marine mammals, birds and estuarine habitats. A summary of the results of the HRA screening is shown in **Error! Reference source not found.**

¹ The Habitats Regulations state that a competent authority “includes any Minister, government department, public or statutory undertaker, public body or any description, or person holding a public office”. Here the competent authority is Perth and Kinross Council.

² Formerly referred to as ‘Natura 2000 Sites’ e.g. SPAs, SACs and proposed SPAs and candidate SACs, and also including Ramsar sites.



Table 1 Summary of HRA screening outcome

DESIGNATED (EU) SITE	DISTANCE FROM PROPOSED DEVELOPMENT	QUALIFYING FEATURES	POTENTIAL EFFECT	IDENTIFIED PATHWAY
The Firth of Tay and Eden Estuary SAC	Within the Site.	Annex II species that are a primary reason for selection of this Site: • Harbour seal <i>Phoca vitulina</i>	Noise and Vibration (Impact of disturbance)	Direct Impacts: This is a direct pathway, but potential impacts are unlikely to cause permanent change.
			Changes in water quality.	Indirect impacts: there is a pathway and although impacts are unlikely there is a risk
The Firth of Tay and Eden Estuary SPA and Ramsar	Within the Site.	The Site supports internationally important assemblage of wintering waterfowl including internationally important populations of several species. Qualities under Article 4.1 by: regularly supporting breeding populations of European importance of the Annex I species: [redacted] [redacted] Qualifies under Article 4.2 by: regularly supporting non-breeding populations of European importance of the migratory species: Redshank <i>Tringa totanus</i> Greylag goose <i>Anser anser</i>	Noise and Vibration (Impact of disturbance)	Indirect impacts: there is a pathway and although impacts are unlikely there is a risk
			Changes in water quality.	Indirect impacts: there is a pathway and although impacts are unlikely there is a risk



		<p>Pink-footed goose <i>Anser brachyrhynchus</i></p> <p>Qualifies under Article 4.2 by: Regularly supporting in excess of 20,000 individual waterfowl over winter (nonbreeding)</p> <p>Velvet scoter <i>Melanitta fusca</i></p> <p>Pink-footed goose</p> <p>Greylag goose</p> <p>Redshank</p> <p>Cormorant <i>Phalacrocorax carbo</i></p> <p>Shelduck <i>Tadorna tadorna</i></p> <p>Eider <i>Somateria mollissim</i></p> <p>Bar-tailed godwit <i>Limosa lapponica</i></p> <p>Common scoter <i>Melanitta nigra</i></p> <p>Black-tailed godwit <i>Limosa limosa islandica</i></p> <p>Goldeneye <i>Bucephala clangula</i></p> <p>Red-breasted merganser <i>Mergus serrator</i></p> <p>Goosander <i>Mergus merganser</i></p> <p>Oystercatcher <i>Haematopus ostralegus</i></p> <p>Grey plover <i>Pluvialis squatarola</i></p> <p>Sanderling <i>Calidris alba</i></p> <p>Dunlin <i>Calidris alpina alpina</i></p> <p>Long-tailed duck <i>Clangula hyemalis</i></p> <p>Qualifies under Ramsar criteria 5 (internationally important numbers of wintering wildfowl) and 6 (species/populations)</p>		
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		occurring at levels of international importance of Pink-footed goose, Greylag goose and Bar-tailed godwit)		
Outer Firth of Forth and St Andrews Bay Complex SPA	1 km from the boundary at the Firth of Tay. This SPA stretches to the south at St Andrews Bay and the Firth of Forth.	<p>Annex 1 populations of European importance, nonbreeding:</p> <p>Red-throated diver <i>Gavia stellata</i></p> <p>Slavonian grebe <i>Podiceps 9inimiz</i></p> <p>Little gull <i>Larus minutus</i></p> <p>Breeding:</p> <p>Common tern <i>Sterna hirundo</i></p> <p>Arctic tern <i>Sterna paradisaea</i></p> <p>Migratory populations of European importance, non-breeding:</p> <p>Eider <i>Somateria mollissima</i></p> <p>Waterfowl assemblage</p> <p>Long-tailed duck <i>Clangula hyemalis</i></p> <p>Common scoter</p> <p>Velvet scoter</p> <p>Goldeneye</p> <p>Red-breasted merganser</p> <p>Breeding:</p> <p>Shag <i>Phalacrocorax aristotelis</i></p> <p>Gannet <i>Morus bassanus</i></p> <p>Seabird assemblage, breeding:</p> <p>Puffin <i>Fratercula arctica</i></p> <p>Kittiwake <i>Rissa tridactyla</i></p>	Noise and Vibration (Impact of disturbance)	Indirect impacts: Indirect pathway and although impacts are unlikely there is a risk
			Changes in water quality.	Indirect impacts: Indirect pathway and although impacts are unlikely there is a risk

		Manx shearwater <i>Puffinus puffinus</i> Guillemot <i>Uria aalge</i> Herring gull <i>Larus argentatus</i> Seabird assemblage, non-breeding: Black headed gull <i>Chroicocephalus ridibundus</i> Common gull <i>Larus canus</i> Herring gull Guillemot Shag Kittiwake Razorbill		
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NatureScot reviewed the HRA screening report and in their capacity as statutory consultees agreed with the conclusions of the HRA screening (Appendix A - Error! Reference source not found.2), stating that the key unanswered questions to be addressed in the Appropriate Assessment are:

- Noise and vibration effects on harbour seals including both those swimming beneath the bridge and at haul out areas (the closest of which is 940m west of the bridge)
- Pollution effects on estuarine habitats including intertidal and subtidal features – particularly those resulting from the proposed hydro-demolition
- Incidental pollution effects, influenced by tidal movements, on waterfowl assemblages and the habitats with which they are associated.

This Shadow Appropriate Assessment aims to address these concerns, identifying the mitigation measures that will be implemented to ensure that the Proposed Development does not adversely affect the integrity of European sites.

2 SHADOW APPROPRIATE ASSESSMENT

2.1 Structure of the Shadow Appropriate Assessment

This section represents Stage 2 of the HRA process and includes:

- A description of the European sites and the features that will be considered further in the shadow Appropriate Assessment, as well as any supporting habitat or processes which contribute to the maintenance of their favourable conservation status;
- A description of the likely effects on the designation features of the European sites in light of their conservation objectives, and assessment of their effects on site integrity;
- Where there is potential for adverse effects, identification and evaluation of any necessary mitigation measures; and
- Conclusions.

2.2 Guidance

In undertaking this shadow Appropriate Assessment, the following guidance was referred to:

- Consultation response received from NatureScot; (see Appendix A - Error! Reference source not found.2)
- Transport Scotland (2020) Design Manual for Roads and Bridges Sustainability & Environment Appraisal LA 115 Habitats Regulations Assessment (formerly HD 44/09) Revision 1
- Joint Nature Conservation Committee (JNCC) (2016). SAC and SPA Standard Data Forms and Ramsar Information Sheets. Available online: <http://www.jncc.gov.uk/>. Accessed [February 2023];
- Environmental Statement report 'Tay Road Bridge Pier Collision Protection Works', Jacobs Ltd. (2010).
- Habitats Regulations Appraisal (HRA) on the Firth of Forth (2016). A Guide for developers and regulators.
- Sound transmission through water–air interfaces: new insights into an old problem, Oleg A. Godin, (2008), journal of contemporary Physics.
- Lawson, J et al. (2015) An assessment of numbers of wintering divers, seaduck and grebes in inshore marine areas of Scotland. JNCC report no. 567, , (Revised 2018).

2.3 Description of the Proposed Development

The Proposed Development will be undertaken in two phases, both of which are outside the winter season, with the current programme likely to be as follows:

- Phase 1: June – September 2023;
- Phase 2: April – August 2024.

Carriageway closures with contraflow traffic management would be used during the works. As the steps are undertaken on the top deck the carriageway closures will allow access to the bridge deck cantilever soffits to undertake the necessary concrete repairs to maintain the integrity of the structure.



Proposed works are as follows:

- Removal of existing asphalt surfacing by means of cold planing and scraping;
- Concrete repairs to top of concrete deck (as necessary);
- Drainage improvement works;
- Captive shot blasting to achieve acceptable finish to concrete deck;
- Spray apply new waterproofing membrane to existing concrete deck;
- Install suspended access platform, hydro-demolition of defective concrete on outer cantilever soffit and carry out spray applied concrete repairs;
- Install new precast concrete kerbs to both sides of carriageway;
- Lay new carriageway surfacing to bridge deck using conventional paving techniques;
- Expansion joint installation at gaps in bridge deck; and
- Installation of road markings and traffic signs.

2.4 Condition Assessment

The condition of each qualifying feature within the European sites has been recorded at a site level as part of NatureScot’s (formerly SNH’s) Site Condition Monitoring (SCM) programme which aims to determine whether a natural feature is likely to maintain itself in the medium to longer term under the current conditions, which include the management regime in place and wider environmental or other influences.

The overall objectives of European sites are:

- To ensure that the qualifying features of each European site are in favourable condition and make an appropriate contribution to achieving favourable conservation status; and
- To ensure that the integrity of the European sites is maintained by meeting the objectives set out in Table 2 for each qualifying feature.
- No specific conservation objectives are available for Ramsar sites, however, they are required to be assessed in the same way as SAC and SPA but the priority for their conservation is of wetland habitats and to promote wise use of wetlands.

Table 2 Qualifying Interests of the European Sites, Conservation Objectives and Threats

DESIGNATED (EU) SITE	SCM STATUS	CONSERVATION OBJECTIVES	THREATS (relevant to the Proposed Development)
The Firth of Tay and Eden Estuary SAC	Harbour seal is in unfavourable /declining condition	Avoid deterioration of harbour seal habitats or significant disturbance to harbour seal; Ensure for harbour seal that the following are maintained in the long term:	Construction and maintenance of structures, both within and adjacent to the sea, have the potential to cause significant disturbance during the breeding, pupping and moulting seasons ³ . This activity also has the potential

³ The pupping season of harbor seals in Scotland typically occurs between June and August, The moulting season for harbor seals in Scotland occurs in late summer or early fall, typically between August and October. In Scotland, the breeding season for harbor seals typically occurs in late summer or early fall, with mating occurring between August and October.

		<p>Population of harbour seal as a viable component of the site;</p> <p>Distribution of harbour seal within site;</p> <p>Distribution and extent of habitats supporting harbour seal;</p> <p>Structure, function and supporting processes of habitats supporting harbour seal; and</p> <p>No significant disturbance of harbour seal.</p>	<p>to cause loss or deterioration of the habitats upon which the seals depend during the same critical periods.</p>
<p>The Firth of Tay and Eden Estuary SPA and Ramsar</p>	<p>Seabird data not provided.</p>	<p>To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, subject to natural change, thus ensuring that the integrity of the site is maintained in the long-term and it continues to make an appropriate contribution to achieving the aims of the Birds Directive for each of the qualifying species.</p> <p>This contribution would be achieved through delivering the following objectives for each of the site's qualifying features:</p> <p>(a) Avoid significant mortality, injury and disturbance of the qualifying features, so that the distribution of the species and ability to use the site are maintained in the long-term;</p> <p>(b) To maintain the habitats and food resources of the qualifying features in favourable condition.</p>	<p>Changes in biotic conditions</p> <p>Other ecosystem modifications</p>
<p>Outer Firth of Forth and St Andrews Bay Complex SPA</p>	<p>Seabird data not provided.</p>	<p>To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, subject to natural change, thus ensuring that the integrity of the site is maintained in the long-term and it continues to make an appropriate contribution to achieving the aims of the Birds</p>	<p>Shipping lanes, ports, marine constructions;</p> <p>Marine water pollution;</p> <p>Pollution to surface waters (limnic & terrestrial, marine & brackish)</p>

		<p>Directive for each of the qualifying species.</p> <p>This contribution would be achieved through delivering the following objectives for each of the site’s qualifying features:</p> <p>(a) Avoid significant mortality, injury and disturbance of the qualifying features, so that the distribution of the species and ability to use the site are maintained in the long-term;</p> <p>(b) To maintain the habitats and food resources of the qualifying features in favourable condition.</p>	
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2.5 Potential effects on European sites

Taking into account the nature of works activities are identified that could have potential effects on the European sites and their qualifying features, as shown in **Error! Reference source not found.**

Table 3 Activities with potential for effects on European sites

Activity	Potential Impact	Potential Effect	Geographic Extent
Disturbance and Displacement			
Road surface removal, concrete repairs, installation of temporary work platforms, use of plant and presence of workforce.	Production of auditory stimuli due to noise, vibration, movement of construction vehicles and personnel. Disturbance to the haul-out behaviour of Harbour seal	Disturbance/displacement of Harbour seal resulting from increased human activity on the bridge during construction and operation. Disturbance events may force the seal to dive underwater frequently and for a longer duration to avoid the disturbances events.	Localised disturbance and displacement on the Firth of Tay, where seals are likely to use intertidal estuarian habitats to haul out.

Activity	Potential Impact	Potential Effect	Geographic Extent
Changes to Water Quality			
Release of chemicals and fine material into the water environment from spills and inundation particularly during removal of existing road and concrete surfaces and installation of new carriageway and joints.	Water pollution from hydrocarbons, salt and chemicals or fine material from the Site to surface water flows or freshwater watercourses (including the Firth of Tay and its tributaries).	Introduction of toxic pollutants or sediments has the potential to result in direct toxicity to qualifying interests and/or loss of, or damage to terrestrial or freshwater environments leading to effects, influenced by tidal movements, on waterfowl assemblages.	Local impacts on the Firth of Tay at proposed outfall locations where pollutants including silt would discharge; effects on water quality both downstream and upstream as determined by tidal influences. Estuarine habitats up- and downstream of works. The Scottish Fisheries Coordination Centre (Scottish Fisheries Coordination Centre 2007). Guidance indicates that up to 100m upstream and downstream of works; and up to 10m from terrestrial bankside habitat may be at risk although the exact distance would depend on the scale of the pollution event.

2.6 Site condition records in relation to the potential effects

2.6.1 Disturbance and Displacement (Noise and Vibration)

Noise and vibration from the regular use of the Tay Road Bridge by vehicular traffic and routine maintenance operations form a baseline of disturbance to which terrestrial and marine wildlife is habituated. In undertaking Environmental Impact Assessments current guidance, DMRB LA 111, reasons that operational vibration is scoped out on the basis that “a *maintained road surface will be free of irregularities as part of project design and under general maintenance, so operational vibration will not have the potential to lead to significant adverse effects.*”

Furthermore, the superseded DMRB Volume 11 Section 3 Part 7 HD 213/11 – Revision 1, provided the following information on road traffic noise:

- Paragraph 3.19 The noise arising from a stream of traffic has two main components. The first component is generated by the engine, exhaust and transmission systems of vehicles and is the dominant source of noise when traffic is travelling at fairly low speeds, or in a low gear. Engine noise from heavy vehicles is commonly the dominant source of low frequency noise. Engine and exhaust noise levels are closely related to engine speed, and transmission noise depends more on the relationship between road speed and engine speed than on vehicle speed.
- Paragraph 3.20 The second component of traffic noise is generated by the interaction of tyres with the road surface, and this is the dominant noise source when traffic is flowing freely at moderate to high speeds. Tyre noise contributes a significant proportion of high frequency noise, especially in wet weather. Tyre noise levels depend on the tyre characteristics and the road surface roughness, but always increase with vehicle speed in this speed range.

Historical road traffic data for the Tay Road Bridge (see Appendix B: Table 3) shows that the number of vehicles using the bridge has changed little between 2008 and 2022 (with variation in vehicle numbers of less than 5% notwithstanding reduced traffic numbers during Covid lockdown). We expect that vehicle speeds and composition (% heavy vehicles) to have followed the same pattern, and very small changes in noise level would occur due to these low flow changes in the past. Thus, it is considered that the noise anticipated from heavy vehicles during construction would be offset by slower road traffic speeds during the works. It is noted that heavy construction vehicles will not exceed normal heavy good vehicles in terms of size and weight. Also, during each phase of work one carriageway is being worked on and therefore closed for regular traffic; on the live carriageway there would be speed restrictions and a single file of traffic.

It is also noted that vibration from proposed construction activities including heavy construction traffic will be attenuated through the structure with vibrations dispersing through the reinforced concrete bridge deck slabs, steel box girders, reinforced concrete diaphragm walls into the bridge bearings. Bridge bearings are noted to be elastomeric products which are used to absorb both vibration and movement within structures resulting in minimal vibrations subsequently being transferred to the reinforced concrete piers and pier foundations.

2.6.2 Changes to Water Quality (Pollution and Estuarine habitats/Waterfowl Assemblage)

Tay Area Advisory Group, which has representatives from the Dundee City Council as well, published a report 'The Tay Area Management Plan (2009- 2015)', the report presents historical record of the Tay catchment area which explains that surface drainage networks, and the estuarine habitats are in good – moderate condition (see **Appendix A: Figure 3**). The report also mentions, "*The main reasons for not achieving good ecological status across the main catchments in the area are described as pressures*". The key pressures affecting the Tay area are:

- abstraction for arable farming purposes;
- abstraction and flow regulation for the production of renewable energy;

- alterations to beds and banks from water collection, purification and distribution, production or renewable energy, fisheries management and farming;
- diffuse pollution from both farming and sewage disposal sources;
- point source pollution from sewage disposal;
- the risk posed by the introduction/expansion of water-related invasive non-native species (INNS).

The above mentioned are identified as the main reasons / pressures that currently affect the estuarine habitats; the operation and maintenance of the Tay Road Bridge has not been identified as putting pressure on the Firth of Tay estuary, and if undertaken sensitively the nature of the Proposed Development does not represent a deviation from routine operations which are currently ongoing.

Linking to the assemblage of waterfowl in estuarine SPA and Ramsar habitat. A paper published on behalf of JNCC (Lawson et al. 2015) presents a summary of the survey data that were available for each species within the Firth of Tay and indicates where they were present in sufficient numbers, under the UK SPA Selection Guidelines. This justifies the potential of SPA habitat to support healthy waterfowl assemblage and hence, it can be assumed that impacts of LSE's that are indirect on the waterfowl assemblage in the estuarine SPA and Ramsar site will be negligible and temporary which will not affect the assemblage numbers of waterfowl in the long term.

Habitats Regulations Appraisal (HRA) on the Firth of Forth – A Guide for developers and regulators states Disturbance whilst foraging as a limiting factor becomes more important in cold weather when birds need to feed for longer to meet their energy requirements. Ecologically, services are overlapping and somehow interconnecting between Firth of Tay and Firth of Forth, both the firths provide vital feeding, breeding, and nesting habitats for a variety of marine and coastal species, including seals, and seabirds, they also support important habitats such as salt marshes and intertidal and tidal mudflats. Thus, it can be mentioned here that the impacts will be negligible in the firth of Tay and Eden estuary SPA as the works are carried out in summer months.

2.7 Shadow Appropriate Assessment

This section addresses the pre-mitigation impacts of the Proposed Development, applies appropriate mitigation measures, and presents a revised assessment of the potential effects with mitigation in place.

The LSEs that were identified during the screening process where there is potential for adverse effects, and are affecting the European sites, as the Tay Road Bridge is at considerable height above the haul-out site of the harbour seal, and within the Firth of Tay and Eden Estuary SPA and Ramsar sites. The LSE's with respective linkages to the nature of works are shown in Table 4 below:

Table 4 Proposed works and their linked Impacts

Impacts	Proposed Works
<p>Noise and vibration effects on harbour seals including both those swimming beneath the bridge and at haul out areas (the closest of which is 940m west of the bridge)</p>	<ul style="list-style-type: none"> ■ Removal of existing asphalt surfacing by means of cold planing and scraping ■ Concrete repairs to top of concrete deck (as necessary); ■ Drainage improvement works; ■ Captive shot blasting to achieve acceptable finish to concrete deck; ■ Install suspended access platform, hydro-demolition of defective concrete on outer cantilever soffit and carry out spray applied concrete repairs; ■ Install new precast concrete kerbs to both sides of carriageway; ■ Expansion joint installation at gaps in bridge deck; ■ Lay new carriageway surfacing to bridge deck using conventional paving techniques;
<p>Incidental pollution effects, influenced by tidal movements, on waterfowl assemblages and the habitats with which they are associated.</p>	<ul style="list-style-type: none"> ■ Removal of existing asphalt surfacing by means of cold planing and scraping ■ Concrete repairs to top of concrete deck (as necessary); ■ Spray apply new waterproofing membrane to existing concrete deck; ■ Install suspended access platform, hydro-demolition of defective concrete on outer cantilever soffit and carry out spray applied concrete repairs; ■ Installation of road markings and traffic signs
<p>Pollution effects on estuarine habitats including intertidal and subtidal features – particularly those resulting from the proposed hydro-demolition.</p>	<ul style="list-style-type: none"> ■ Install suspended access platform, hydro-demolition of defective concrete on outer cantilever soffit and carry out spray applied concrete repairs; ■ Removal of existing asphalt surfacing by means of cold planing and scraping ■ Concrete repairs to top of concrete deck (as necessary); ■ Drainage improvement works; ■ Captive shot blasting to achieve acceptable finish to concrete deck; ■ Spray apply new waterproofing membrane to existing concrete deck;

Table 5 justifies with evidence that there will not be any adverse impact on the integrity of any of the European sites taking account of all the mitigation measures and outcomes of consultations with experts and their opinions to control the adverse impact at the source / origin. Key to the conclusion of negligible impacts (and no adverse impact on site integrity) is the following:

- Airbourne noise is not considered to transmit into water therefore submerged seals would not be anticipated to be affected by construction-related noise (or changes to traffic-related noise);



- Noise attenuation through air is such that seals using haul-out sites which are distant from the immediate vicinity of the Tay Road Bridge would not be affected (at the noise intensity, duration and frequency of sounds anticipated from the various work stages);
- Interception and treatment of silty or polluted water or other waste or arisings from the Proposed Development would prevent direct ingress of most pollutants into the estuary; emergency response planning together with dilution effects of potential pollutants entering the estuary are not considered to be significantly greater than the current risk in relation to estuarine habitats and seabird communities. i

Table 5 Assessment of residual effects on the European site qualifying features considering nature of works and mitigation measures.

Stage	Work element	Plant description/ Activity	LSE to address	Pre mitigation effect	Magnitude, duration & reversibility of the effects	Mitigation proposed	Post mitigation Impact	Any assumptions made and evidence or advice used
1	Site compound – • Installation • Operation	<ul style="list-style-type: none"> Lorry Power for site cabins: Diesel generator 	<ul style="list-style-type: none"> Noise and vibration effects on harbour seals 	Direct effects on harbour seals including both those swimming beneath the bridge and at haul out areas	The drive-by maximum noise level is predicted to be 78 dB L _{Amax} at 10m from the bridge deck, and the average noise level is predicted to be 59 dB L _{Aeq} at 10m from the bridge deck over the working period.(Operation time)	<ul style="list-style-type: none"> Contractor shall shut off all vehicles and machinery when not in use Contractor shall ensure that all vehicles and mechanical plant used in the works are fitted with effective exhaust silencers and are maintained in good and efficient working order so as to minimise noise. 	No Impact	<p>In underwater acoustic modelling, the air-to-water interface is treated as a reflecting surface to airborne sound, this means that airborne noise is not considered to transmit into the water (Godin, O. A 2008).</p> <p>At 900+ meters (nearest haul out site) from the source of noise, the impact of airborne noise on seals at haul outs in the Firth of Tay will be less severe than at closer distances, thus with provision of mitigation measures at-source, the impact is reduced to none.</p>
2	Site clearance – • Kerb & joint removal • Material removal • Surface removal	<ul style="list-style-type: none"> Breaker mounted on wheeled backhoe Lorry Captive shot blasting – Ride-on Road planer Wheeled excavator 	<ul style="list-style-type: none"> Noise and vibration effects on harbour seals. 	Direct effects on harbour seals including both those swimming beneath the bridge and at haul out areas	The loudest item of plant during this work element is the breaker mounted on a wheeled backhoe, the average noise level is predicted to be 87 dB L _{Aeq} at 10m from the bridge deck over the working period. (Operation time)	<ul style="list-style-type: none"> Vehicles and mechanical plant will be maintained in a good and effective working order and operated in a manner to minimise noise emissions. The Contractor will ensure that all plant complies with the relevant statutory requirements. All pneumatic tools will be fitted with silencers/mufflers. 	No Impact	<p>In underwater acoustic modelling, the air-to-water interface is treated as a reflecting surface to airborne sound, this means that airborne noise is not considered to transmit into the water. (Godin, O. A 2008).</p> <p>As for Stage 1 works seal haul-outs are at distances outside of those that would be anticipated to cause disturbance.</p>
3	Concrete removal • Soffit • Top deck	<ul style="list-style-type: none"> Hydro-demolition Petrol hand-held circular saw Water pump (diesel) Siltbuster Petrol hand-held circular saw 	<ul style="list-style-type: none"> Incidental pollution effects, influenced by tidal movements, on estuarine habitats and waterfowl assemblages 	Indirect Impacts	Water quality may be altered affecting seabird prey availability temporarily, due to fines released from concrete during the process of hydro-demolition.	<ul style="list-style-type: none"> All temporary access platforms installed underneath the bridge deck will be fully sheeted using Monaflex or similar. Sumps will be created within the scaffold system to contain the run-off water. A sub pump will be positioned within the sumps to transfer the collected run-off water to a Siltbuster HD unit located on the bridge deck directly above the repair area. Debris netting and small silt dams to be created around the pump to 	No Impact	As the works planned will be carried out at the bridge and direct disposal of the silt will not take place directly into the Firth of Tay. The proposed measure will eliminate the minimal risk of incidental pollution. In case there is any sudden leak, the task will be stopped immediately to cease the discharge at source.

		<ul style="list-style-type: none"> Hand-held hydraulic breaker 				<p>keep the majority of the solids in the sump for disposal later. Due to the relatively low flow rate the Siltbuster will be able to take out remaining particles down to 5 microns. Residuals of less than 5 microns in this work element will not have potential to impact on the quality of water.</p> <ul style="list-style-type: none"> The Siltbuster also has the facility to autonomously reduce the pH of the water to ensure it remains between pH7 & pH8.5 using CO₂. The treated water is to be discharged into the estuary. Discharge to the ground is not permitted. The Contractor will take responsibility for ensuring this method is carried out. 		<p>Spills or other environmental incidents would be dealt with in line with a bespoke Construction Environmental Management Plan produced by the Contractor for the works which will set out the plan for emergency response to environmental incidents..</p>
			<ul style="list-style-type: none"> Pollution effects on estuarine habitats including intertidal and subtidal features 	Indirect Impacts	Water quality may get altered due to contaminants from waterproofing and machinery. However, the impacts will be temporary and reversible.		No Impact	<p>There will be no direct discharge to the Firth of Tay (i.e. all water/runoff will be treated prior to discharge).</p> <p>Treated water will be discharged and the volume of the discharge as compared to the receiving water body will be negligible.</p>
			<ul style="list-style-type: none"> Noise and vibration effects on harbour seals 	Direct effects on harbour seals including both those swimming beneath the bridge and at haul out areas	The loudest item of plant during this work element is hydro-demolition, the average noise level from the bridge deck over the working period, is predicted to be 100 dB L _{Aeq} at 10m and 72 dB L _{Aeq} at 300m.	<ul style="list-style-type: none"> Echo H4 Acoustic Barrier (or similar) <ul style="list-style-type: none"> Noise at source = 120dB. Reduction = 10dB (100Hz) – 40.8dB (4500Hz). Possible resultant noise level on the bridge = 110dB – 80dB Can be fitted around compressors / power sources / general plant. 	No Impact	<p>In underwater acoustic modelling, the air-to-water interface is treated as a reflecting surface to airborne sound, this means that airborne noise is not considered to transmit into the water (Godin, O. A 2008).</p> <p>As for Stage 1 works seal haul-outs are at distances outside of those that would be anticipated to cause disturbance.</p> <p>The total duration of works can be split in sessions, such that continuous impacts can be avoided.</p>
4	<p>Carriageway –</p> <ul style="list-style-type: none"> Drainage outlets Expansion joints, kerbs Road surfacing Soffit Top deck Waterproofing 	<ul style="list-style-type: none"> Core drill (electric) Petrol hand-held circular saw Hand-held hydraulic breaker Lorry with lifting boom Lorry with lifting boom 	<ul style="list-style-type: none"> Noise and vibration effects on harbour seals. 	Direct effects on harbour seals including both those swimming beneath the bridge and at haul out areas.	The loudest item of plant during this work element is the hand-held hydraulic breaker, the average noise level is predicted to be 88 dB L _{Aeq} at 10m from the bridge deck over the working period. (operation time)	<ul style="list-style-type: none"> Vehicles and mechanical plant will be maintained in a good and effective working order and operated in a manner to minimise noise emissions. The Contractor will ensure that all plant complies with the relevant statutory requirements. When replacing older plant, ensure that the quietest plant available is considered. Drop heights will be minimised when loading vehicles with materials/waste. Vehicles will be prohibited from waiting within the site with their engines running or alternatively be located in waiting areas away from sensitive receptors. 	No Impact	<p>In underwater acoustic modelling, the air-to-water interface is treated as a reflecting surface to airborne sound, this means that airborne noise is not considered to transmit into the water (Godin, O. A 2008).</p> <p>As for Stage 1 works seal haul-outs are at distances outside of those that would be anticipated to cause disturbance.</p>

		<ul style="list-style-type: none"> Asphalt paver (+ tipper lorry) Road roller Sprayed concrete Small cement mixer Diesel surface water pump 	<ul style="list-style-type: none"> Pollution effects on estuarine habitats including intertidal and subtidal features 	Indirect Impacts	Water quality may get altered temporarily affecting prey availability due to fines released from concrete during hydro-demolition, and mixing of contaminants from waterproofing .	<ul style="list-style-type: none"> Local hoarding, screens or barriers should be erected to shield particularly noisy activities Hours of operation will be strictly enforced and any deviations other than those previously will be with the consent of the Local Authority and the Project Manager. Stop spillage , if possible, without risk. Absorb spillage with non-combustible, absorbent material. Collect and place in suitable waste disposal containers and seal securely. Label the containers containing waste and contaminated materials and remove from the area as soon as possible. If involved in a fire, shut off flow if it can be done without risk Dispose of waste to licensed waste disposal site in accordance with the requirements of the local Waste Disposal Authority. Dispose of waste via a licensed waste disposal contractor. 	No Impact	<p>Retaining waste transfer notes (WTN)</p> <p>Visual inspection not flagging up any evidence of pollutants</p> <p>Guidelines for Pollution Prevention (GPP) will be followed at all times when working on site.</p>
5	<p>Site maintenance</p> <ul style="list-style-type: none"> Road cleaning 	<ul style="list-style-type: none"> Road sweeper Dust suppression unit trailer 	<ul style="list-style-type: none"> Noise and vibration effects on harbour seals 	Direct effects on harbour seals including both those swimming beneath the bridge and at haul out areas	The loudest item of plant during this work element is the dust suppression trailer, the average noise level is predicted to be 63 dB L _{Aeq} at 10m from the bridge deck over the working period.	<ul style="list-style-type: none"> Reduce the speed of construction vehicle movements (maximum 10 miles/hour.) Vehicles will be prohibited from waiting within the site with their engines running or alternatively be located in waiting areas away from sensitive receptors. Restrict the number of plant items in use at any one time. 	No Impact	<p>In underwater acoustic modelling, the air-to-water interface is treated as a reflecting surface to airborne sound, this means that airborne noise is not considered to transmit into the water Godin, O. A 2008).</p> <p>As for Stage 1 works seal haul-outs are at distances outside of those that would be anticipated to cause disturbance.</p>

2.8 In-Combination Effects

In accordance with the Habitats Regulations, as well as considering the potential for likely significant effects and adverse impacts on site integrity from the Proposed Development in isolation, the HRA must also consider those effects in combination with those associated with other plans or projects, wherever residual effects are anticipated.

With the successful adoption of the design and mitigation measures specified in Table 5 it has been concluded that the residual effects of the construction of the Proposed Development on the European sites will be negligible (i.e. no discernible change and no threat to site integrity) and therefore there is no basis on which to consider in-combination effects.

3 CONCLUSIONS

The proposed development with mitigation would result in temporary, minimal noise and vibration effects on harbour seals that would not affect the conservation objectives of the Firth of Tay & Eden Estuary SAC .

The mitigation measures included within the assessment are designed to prevent or reduce potential harmful effects arising from spillages/pollution events therefore, no residual effect will exist that can cause any adverse effect on the integrity of the European sites.

Based on the detailed assessment of all the potential impacts, the nature of works in relation to the size and condition of the European sites can be considered as temporary and minimal and will not result in any adverse effect on the integrity of the European sites listed below:

- The Firth of Tay and Eden Estuary SAC;
- The Firth of Tay and Eden Estuary SPA; and
- The Outer Forth and St Andrews Bay Complex SPA.

4 REFERENCES

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- Transport Scotland (2020) Design Manual for Roads and Bridges Sustainability & Environment Appraisal LA 115 Habitats Regulations Assessment (formerly HD 44/09) Revision 1.
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UK Government (2021). Habitats Regulations Assessment: protecting a European site. [Online]. Available at: <https://www.gov.uk/guidance/habitats-regulations-assessments-protecting-a-european-site>

WSP Ltd (2022) Habitats Regulations Appraisal (Screening Report), Prepared on behalf of Tay Road Bridge Joint Board'

Appendix A: Figures

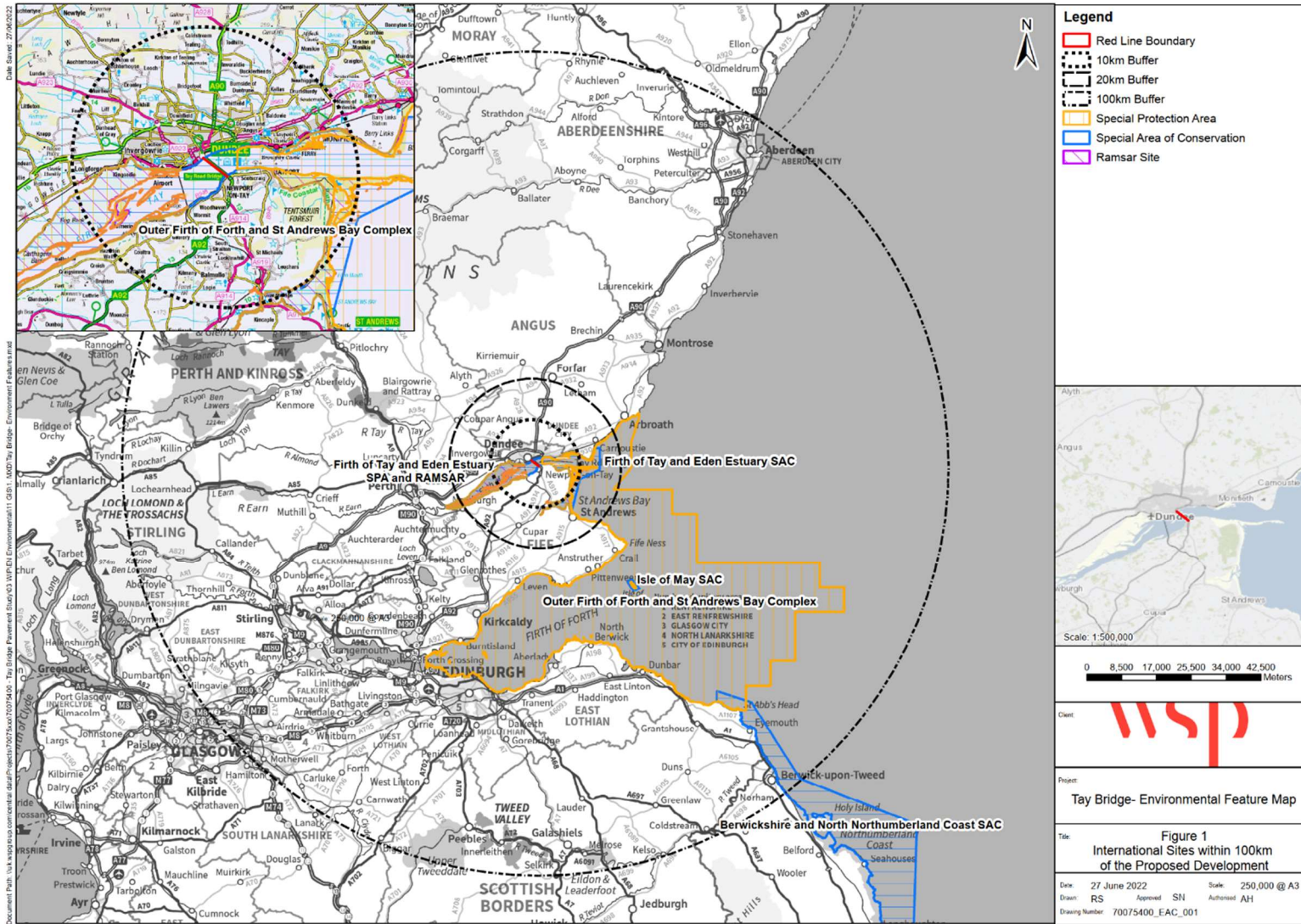


Figure 1 - International Sites within 100 km of the Proposed Development

From: [Redacted]
Sent: 26 September 2022 16:26
To: [Redacted]
Subject: Tay Road Bridge Resurfacing & Maintenance (7007 5400) - HRA Screening

Follow Up Flag: Follow up
Flag Status: Flagged

Our Ref: CPA 168215

Dear [Redacted]

Thank you for your email and HRA Screening Report. At this current time we are experiencing resource issues, so we apologise for a slightly late response to your request.

Summary

We provide advice to help inform screening of works on the Tay Road Bridge. We agree with the conclusions within the Environmental Screening Report.

Appraisal of impacts and our advice

The Tay Road Bridge falls within the boundary of the Firth of Tay & Eden Estuary Special Area of Conservation (SAC) protected for its marine habitats and harbour seal. The very western edge of the Outer Firth of Forth & St Andrews Bay Complex Special Protected Area (SPA), protected for its range of water-birds, lies at a distance of approximately 1km. The Firth of Tay & Eden Estuary SPA, protected for its wetland, estuarine & marine birds, lies further away from the bridge at a separation distance of approximately 2.5km.

European Sites

Firth of Tay & Eden Estuary SAC

Harbour seal is likely to be the most sensitive receptor to this proposed operation. The works are likely to introduce new vibration/noise elements to the existing background traffic noise that seals will have become accustomed to. This is likely to permeate through the supporting bridge uprights into the SAC below. Therefore, this SAC species warrants full consideration assessing any likely impacts against all of the Conservation Objectives. The nearest known harbour seal haul-out appears to be 'middle-bank', which lies approximately 940m west of the bridge. At this distance, disturbance effects are probably unlikely, however the bridge is a considerable height above the haul-out site, therefore this issue requires more detailed consideration within the HRA.

We agree that both intertidal & subtidal features should be screened in for further consideration, focusing on pollution prevention measures as an integral part of this proposal. Likewise, 'Estuaries' should receive the same level of assessment, focusing again on pollution prevention, utilising best practice approaches as far as possible. As the assessment for these three features will rely on levels of best practice & mitigation, it would seem reasonable that any shadow Habitats Regulation Appraisal (HRA) could assess these three SAC interests collectively, to save repetition.

We note that hydro-demolition is proposed for use under the bridge, where concrete fines within the water may end up within the SAC. During maintenance works on the Dornoch Firth Bridge (Sutherland - Highland), BEAR Scotland proposed to discharge spent hydro-demolition water into the estuarine SAC, but only after it had gone through a silt-buster, with the pH neutralised by carbon dioxide in advance. Would it be possible to adopt a similar approach for the Tay? Please contact BEAR Scotland at Inverness for further information.

It's not totally clear at this stage how the work phases (phase 1 & 2) relate to the four step work method presented. In this regard, we would welcome that any specific operation that increases risk of pollution to this SAC, is carried out either during short periods of settled weather, or during the summer/early autumn months.

A Conservation & Management Advice document for this SAC, complete with revised 'restoration' Conservation Objectives (CO's for harbour seal) is likely to be available within the next 6 months or so. Please check this SAC Protected Areas page before finalising your HRA Report, as this proposal may require new CO's to be incorporated, see: <https://sitebank.nature.scot/site/8237>.

Outer Firth of Forth & St Andrews Bay SPA

Firth of Tay & Eden Estuary SPA

As these SPA's are located at a separation distance of >1km, screening should mainly focus on pollution prevention measures, reducing the risk that both these SPAs may be affected by any incidental effects, influenced by tidal movements. Therefore, using this pragmatic approach, it would seem reasonable to assess relevant SPA features collectively within any shadow HRA, again focussing on pollution prevention with high importance to safeguard both SPAs interests and supporting habitats.

Concluding comments

I hope the above information is of some help. Feel free to get back in touch should you need further clarification or additional advice.

With best regards,

[Redacted]

[Redacted]
[nature.scot](https://www.nature.scot) | [@nature_scot](https://twitter.com/nature_scot) | Scotland's Nature Agency | *Buidheann Nàdair na h-Alba*

t: [Redacted] (which is diverted to my mobile).

Please note, I normally work Mon-Thurs only.

Figure 2 - Consultation response received from NatureScot (contact details redacted for GDPR reasons)

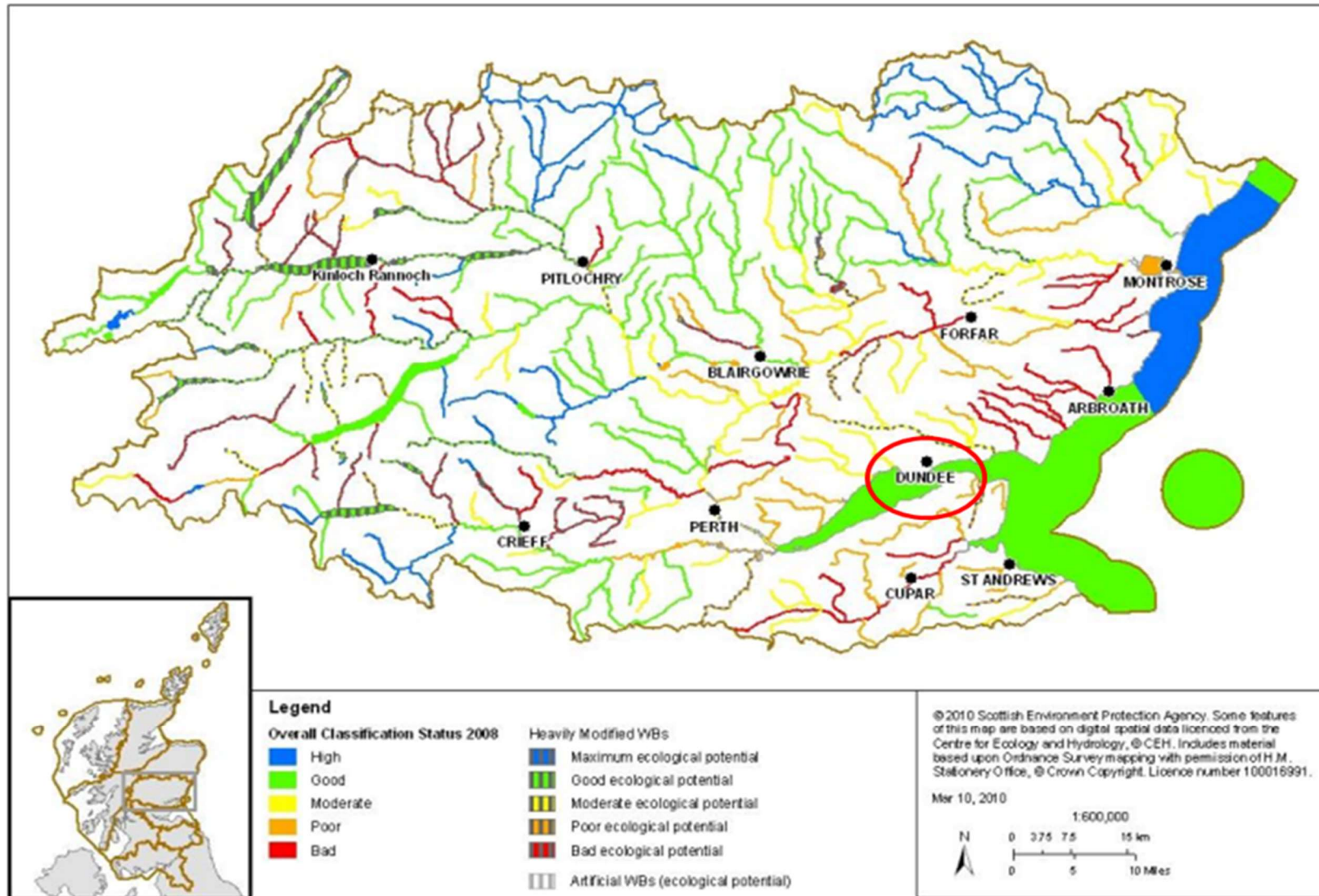


Figure 3 - condition of surface and coastal water bodies in Tay Advisory Group area

Appendix B: Noise Level Tables

Table 1: Bridge resurfacing works plant list and predicted construction noise levels (airborne)

Phase/Activity	Plant description	BS 5228-1 reference	Noise level at 10m	Noise level equiv. / max.	No. of plant items	Percentage on-time	Resultant noise level (dBA) (Corrected for no. of plant, % on-time and stated distance)					
							10m	25m	50m	100m	200m	300m
Site compound - Installation	Lorry	C.02 #34	80	dB L _{Amax}	1	-	78	72	66	60	54	50
Site compound - Operation	Power for site cabins: Diesel generator	C.04 #76	61	dB L _{Aeq}	2	50%	59	53	47	41	35	31
Site clearance - Kerb & joint removal	Breaker mounted on wheeled backhoe	C.01 #1	92	dB L _{Aeq}	1	50%	87	81	75	69	63	59
	Lorry	C.02 #34	80	dB L _{Amax}	1	-	78	72	66	60	54	50
Site clearance - Surface removal	Road planer	C.05 #7	82	dB L _{Aeq}	1	50%	77	71	65	59	53	49
	Wheeled excavator	C.05 #11	73	dB L _{Aeq}	1	75%	70	63	58	52	46	42
Site clearance - Material removal	Captive shot blasting - Ride-on	M.01 #4	85	dB L _{Aeq}	1	75%	82	75	70	64	58	54
Concrete removal - Top deck	Petrol hand-held circular saw	C.04 #70	91	dB L _{Aeq}	2	20%	85	79	73	67	61	57

APPENDICES

Phase/Activity	Plant description	BS 5228-1 reference	Noise level at 10m	Noise level equiv. / max.	No. of plant items	Percentage on-time	Resultant noise level (dBA) (Corrected for no. of plant, % on-time and stated distance)					
							10m	25m	50m	100m	200m	300m
	Hand-held hydraulic breaker	C.01 #7	93	dB L _{Aeq}	2	30%	89	82	77	71	65	61
Concrete removal - Soffit	Petrol hand-held circular saw	C.04 #70	91	dB L _{Aeq}	2	20%	85	79	73	67	61	57
	Hydro-demolition	M.01 #2	102	dB L _{Aeq}	2	50%	100	94	88	82	76	72
	Water pump (diesel)	C.04 #88	68	dB L _{Aeq}	2	75%	68	61	56	50	44	40
	Siltbuster	M.01 #1	50	dB L _{Aeq}	2	75%	50	43	38	32	26	22
Carriageway - Top deck	Small cement mixer	C.04 #23	61	dB L _{Aeq}	1	50%	56	50	44	38	32	28
Carriageway - Soffit	Sprayed concrete	M.01 #5	82	dB L _{Aeq}	1	50%	77	71	65	59	53	49
Carriageway - Kerbs	Lorry with lifting boom	C.04 #53	77	dB L _{Aeq}	1	50%	72	66	60	54	48	44
Carriageway - Drainage outlets	Core drill (electric)	C.04 #69	85	dB L _{Aeq}	2	50%	83	77	71	65	59	55
Carriageway - Waterproofing	Diesel surface water pump	C.08 #22	71	dB L _{Aeq}	2	75%	71	64	59	53	47	43

APPENDICES

Phase/Activity	Plant description	BS 5228-1 reference	Noise level at 10m	Noise level equiv. / max.	No. of plant items	Percentage on-time	Resultant noise level (dBA) (Corrected for no. of plant, % on-time and stated distance)					
							10m	25m	50m	100m	200m	300m
Carriageway - Road surfacing	Asphalt paver (+ tipper lorry)	C.05 #33	75	dB L _{Aeq}	1	50%	70	64	58	52	46	42
	Road roller	C.05 #19	80	dB L _{Amax}	1	-	78	72	66	60	54	50
Carriageway - Expansion joints	Petrol hand-held circular saw	C.04 #70	91	dB L _{Aeq}	2	25%	86	80	74	68	62	58
	Hand-held hydraulic breaker	C.01 #7	93	dB L _{Aeq}	2	25%	88	82	76	70	64	60
	Lorry with lifting boom	C.04 #53	77	dB L _{Aeq}	1	25%	69	63	57	51	45	41
Site maintenance - Road cleaning	Road sweeper	C.04 #90	76	dB L _{Aeq}	1	5%	61	55	49	43	37	33
	Dust suppression unit trailer	C.04 #91	78	dB L _{Aeq}	1	5%	63	57	51	45	39	35

Table key: Black text: Source sound level, L_{Aeq}, data from BS 5228-1 Annex C; Orange text: Source sound level, L_{Amax}, data from BS 5228-1 Annex C; and blue text: Source sound level, L_{Aeq}, data from third party specialist plant supplier

Table 2: Averaged Noise Measurement Results, Tay Shore (Jacobs Environmental statement 2010)

Location	Noise Levels dB	
	L _{Aeq}	L _{A90}
1. Tay Shore	54	51
2. Tayview Terrace	56	52
3. Car Park to the East of the Bridge	63	52
4. Tay Bridge, 3m from Southbound Carriageway	84	71
5. Tayview Care Home Garden to North of Property		
Weekday, 07:00 – 19:00	57	53
Weekday, 19:00 – 23:00	54	46
Nighttime 23:00 – 07:00	52	40
Saturday 07:00 – 13:00	57	52
Saturday 13:00 – 23:00	56	50
Sunday 07:00 – 23:00	57	51

Table 3: Road Traffic historical data

	Feb 2008 – Jan 2009	Feb 2009 - Jan 2010	Feb 2021- Jan 2022	Feb 2022 – Jan 2023
1st Quarter (Feb-Apr)	25,158	25,278	18,054 *COVID Lockdown2	24,967
2 nd Quarter (May-Jul)	26,114	27,343	24,282	26,951
3rd Quarter (Aug-Oct)	26,315	25,791	26,505	26,388
4th Quarter (Nov-Jan)	23,854	22,229	25,023	**Data not yet available



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