

Appendix A8.2: Outline Saltmarsh Management Plan

1 Introduction

- 1.1 This Outline Saltmarsh Management Plan sets out the outline management approach, as agreed during consultation with Scottish Natural Heritage (SNH), for protection of the saltmarsh surrounding the Kincardine Bridge during the replacement of the piled viaduct (the proposed scheme) on the southern shore of the Firth of Forth. This management plan has been identified as essential mitigation within the Environmental Impact Assessment Report (EIA Report) and details other essential mitigation identified to avoid or minimise effects on the saltmarsh. The location of the proposed works and the surrounding saltmarsh habitat fall within the Firth of Forth Special Protection Area (SPA) and Firth of Forth Site of Special Scientific Interest (SSSI).
- 1.2 The aim of the Saltmarsh Management Plan is to enable successful recovery of the saltmarsh to its pre-construction state and to avoid compromise of the saltmarsh ecosystem. This will include pre- and post-construction monitoring and identifies points at which intervention may be required. This plan is a live document which will be developed by the Contractor prior to construction as part of the Ecological Management Plan for the proposed scheme. The Ecological Management Plan will ensure that essential mitigation strategies required for safeguarding protected species and habitats are implemented as part of the contract. The Ecological Management Plan will be developed in consultation with relevant stakeholders including SNH.
- 1.3 The Ecological Management Plan will be included as an annex to the Construction Environmental Management Plan (CEMP) which will be developed by the Contractor prior to construction as stated in **Mitigation Item ME1** of the EIA Report (Chapter 17: Schedule of Environmental Commitments). The CEMP will follow guidance set out in the Design Manual for Roads and Bridges (DMRB) Guidance Document LA 120 Environmental management plans (Highways England, Transport Scotland, Welsh Government and Department for Infrastructure Northern Ireland 2020).

2 The Proposed Scheme

- 2.1 The proposed scheme is described in Chapter 3 (The Proposed Scheme) of the EIA Report. The proposed scheme is located at the southern end of the Kincardine Bridge; this structure crosses the Firth of Forth between Higgins Neuk in Falkirk Council area and the town of Kincardine in Fife Council area. As part of the proposed scheme the existing piled viaduct will be demolished and replaced with a five-span structure of similar appearance to the adjacent spans of the existing Kincardine Bridge. A temporary bridge will be erected during construction to maintain traffic flow in both directions, except when work requires single lane or full closure of the bridge for limited periods. The indicative construction methodology includes a temporary raised working platform which would be created on the saltmarsh under and adjacent to the existing piled viaduct. This platform must be capable of supporting the required construction plant and will be created using a geotextile layer covered by aggregate material and will include filling of the creeks.
- 2.2 Following construction, the temporary bridge will be removed and the associated piles will be cut 1m below the surface rather than being broken up and removed. The remainder of the temporary structure and the working platform in its entirety will be removed from the saltmarsh.
- 2.3 It is currently anticipated that construction will not commence before summer 2021 (subject to completion of statutory procedures) and the overall construction period is expected to be between 18 to 24 months. However, the design of the temporary works, construction methods and programme for the proposed scheme will be the responsibility of the Contractor, who will be appointed during the procurement stage. The Contractor's design of the temporary works and construction of the proposed scheme must be within the constraints imposed by the Environmental Impact Assessment (EIA) Report

and Habitats Regulations Assessment (HRA). Design changes will be subject to environmental review to ensure compliance with environmental commitments and mitigation to safeguard the Firth of Forth SPA/Ramsar site and other ecological features, including saltmarsh.

3 Baseline Saltmarsh Conditions

- 3.1 Saltmarsh habitat is a feature of the Firth of Forth SSSI and provides supporting habitat for the bird species for which the SPA is designated. The conservation objectives for the SPA and SSSI include avoiding deterioration of, and maintenance and enhancement of, the distribution and extent of habitat supporting the qualifying species. Atlantic salt meadows (*Glauco-Puccinellietalia maritima*) are listed on Annex I of the European Union Directive (92/43/EEC) on the Conservation of natural habitats and of wild fauna and flora (Habitats Directive). Coastal saltmarsh is also included on the Scottish Biodiversity List (Scottish Government 2013) and as a priority habitat on the Estuary Action Plan, part of the Falkirk Council Biodiversity Action Plan (Falkirk Council 2019).
- 3.2 Results of a saltmarsh survey undertaken up to 150m either side of the Kincardine Bridge on the southern shore of the estuary in June 2018 are presented in Appendix A8.1 (Detailed Saltmarsh Baseline). Overall the survey confirmed that the vegetation communities had relatively low diversity and were typical of those found throughout the wider Firth of Forth. National Vegetation Classification (NVC) communities SM13 (*Puccinellia maritima* low marsh) and SM16 (*Festuca rubra* mid marsh) were found to be the dominant communities both up and downstream of the existing bridge. These results were consistent with previous surveys in the area (Northern Ecological Services 2003).
- 3.3 Within the 2018 survey extent was an area previously covered by a hardcore ramp which was visibly different from the surrounding saltmarsh. However, whilst this area was found to have had an identical species list to other parts of the saltmarsh, the proportions of the species differed. The main difference was the lower abundance of sea arrowgrass (*Triglochin maritima*), which was the second most dominant species in other areas of SM13. Sea arrowgrass is a relatively conspicuous grass species and the lower abundance of this species accounted for the marked difference in appearance. In contrast, this previously disturbed area had a slightly higher proportion of bare ground and higher abundances of common saltmarsh-grass (*Puccinellia maritima*) and common scurvy-grass (*Cochlearia officinalis*). The SM13 community includes a wide range of closely-related vegetation types (Rodwell et al. 2000) and the various associate species, including sea arrowgrass, can vary with the level of the marsh. In lower areas, tidal inundation times are extended, leading to development of vegetation more tolerant of inundation even though the NVC type may remain the same.
- 3.4 While the saltmarsh around the Kincardine Bridge is relatively species poor and does not contain any species of conservation interest, it is typical of saltmarsh throughout the wider estuary (Proctor 1987) and is important for maintenance of the habitat on a broader scale.

4 Potential Impacts

- 4.1 During the refurbishment works there will be temporary loss of up to 2.99ha saltmarsh habitat under the footprint of the land made available for temporary works and construction. The working platform will consist of a geotextile layer covered by aggregate and will be in place for the duration of the construction period which is expected to be between 18 and 24 months as stated. During this time, it is anticipated that all saltmarsh vegetation in this area will be lost.
- 4.2 Construction activities and vehicles on the working platform introduce the potential for impacts on the saltmarsh from construction site run-off or accidental spillages. Saltmarsh communities are identified as highly sensitive to hydrocarbon pollution as they trap sediments, adsorb oil and occur in sheltered areas where oils persist (Tyler-Walters 2014).

- 4.3 The presence of the working platform will also result in localised changes in hydrology on the saltmarsh which could alter erosion and deposition in the immediate area.
- 4.4 It is anticipated that compression of the sediments under the working platform will occur and that, upon removal of the working platform, the ground level in this area will be lower than the surrounding saltmarsh. This may affect the natural recovery of the saltmarsh in this location.

5 Pre-construction Surveys

- 5.1 During the summer prior to construction, surveys will be carried out by ecologists acting on behalf of Transport Scotland to record the cover and species composition of the saltmarsh area under the footprint of the land made available for temporary works and construction and to a distance of 50m either side. The approach for this will follow that set out in Rodwell (2006):
- Identify homogenous stands of vegetation.
 - Conduct five 2m x 2m quadrats in each homogenous stand. The saltmarsh on either side of the bridge should be treated as separate habitats. Record presence and percentage cover of every species with each quadrat. Percentage cover of bare ground and algal mat within each quadrat should also be recorded.
 - Where an area of distinct habitat is too small for the standard protocol, a technique for recording, which enables robust monitoring should be used, such as fewer or smaller quadrats.
 - Accurately record the GPS position of each quadrat, including alignment to ensure accurate resurvey.
 - Convert percentage cover into Domin values and calculate frequency as a count of how many quadrats (1-5) in which a species was recorded. Use these values to create floristic tables which can be compared to those in Rodwell (2000) to determine NVC communities. NVC matching software can facilitate this process.
 - Create location plan showing extent of NVC communities.
- 5.2 The results of this survey, including accurate GPS positions, will be made available to the Contractor in the form of a short technical report.
- 5.3 Prior to the onset of any works on the saltmarsh, the Contractor must ensure that ground levels are measured throughout the area to be covered by the working platform and a minimum of 50m either side. These must be recorded as this will enable determination of the extent of ground compression following removal of the working platform relative to the surrounding saltmarsh. The location, width and depth of saltmarsh creeks should also be mapped in detail by the Contractor at this time. This information must be made available to the Transport Scotland and/or statutory bodies if requested.
- 5.4 Aerial imagery and LiDAR are useful tools to enable production of topographical and ground cover maps of the area, but will not provide the required vegetation composition data.

6 Construction Mitigation

- 6.1 Mitigation measures identified as part of the environmental impact assessment (EIA) are detailed in Chapter 17 (Schedule of Environmental Commitments) of the EIA Report. General mitigation items relevant to the saltmarsh include production of a Construction Environmental Management Plan (CEMP), including an Ecological Management Plan, and the presence of a suitably qualified Ecological Clerk of Works (ECoW) to ensure that all mitigation measures are implemented. Compliance will be monitored by an ecologist acting on behalf of Transport Scotland.
- 6.2 Production of this Saltmarsh Management Plan was identified as essential mitigation for the project. The following measure must be included in this plan:

- Methodology for restoration of saltmarsh geomorphological features (including creeks) following removal of the working platform;
- Pre and post construction monitoring of saltmarsh habitat, by a suitably qualified Environmental Clerk of Works (EnvCoW), to include photographic record of existing creeks, habitat types and extent, species diversity and scour assessments around new or removed structures; and
- Measures to minimise future scour and erosion and promote recovery of saltmarsh vegetation.

6.3 Additional mitigation measures to protect the saltmarsh include:

- Best practice construction methods (CIRIA 2015) will be used including the use of appropriate pollution controls (i.e. Guidance for Pollution Prevention (GPPs)), such as construction drainage, a strict re-fuelling protocol and removal of all loose materials from the intertidal area.
- The footprint of the working area will be minimised as far as possible and vehicles, plant and personnel will be constrained to this area through the use of temporary barriers to minimise the damage to habitats and potential direct mortality and disturbance to animals located within and adjacent to this footprint. The access track and working platforms on the saltmarsh will be created through use of a geotextile layer under aggregate material.
- On completion of the works all access tracks and working platforms will be removed in their entirety from the saltmarsh.
- With the exception of temporarily realigning the existing Sustainable Drainage System (SuDS) outfall, no works will be undertaken on the saltmarsh outside the footprint of the working platform and access tracks. This includes provision of drainage or water treatment facilities for construction runoff.
- Any saltmarsh damaged as a result of the temporarily realigned drainage will be included in the area subject to recovery measures.
- During construction the ECoW will monitor the edges of the working platform for signs of increased erosion of saltmarsh habitats and creeks. In the event the erosion is evident, specialist advice will be sought and corrective actions taken to minimise any further erosion.

7 Post Construction

Habitat Recovery

- 7.1 As soon as practicable after removal of the working platform, within a maximum of one month, ground levels in the affected area and to 50m either side should be accurately measured by the Contractor to determine the extent of ground compression relative to the surrounding saltmarsh. Additionally, the Contractor should accurately map creeks to ensure that all fill has been removed and allow a plan to be prepared on how the creeks will be returned to their pre-construction size and depth. A photographic and written record should be made.
- 7.2 In order to assist the recovery of the saltmarsh it will be necessary to raise the ground level in the affected area. The following two options for this have been considered:
- deposition of material onto the affected area (recharging or backfilling); or
 - installing measures to encourage accretion of sediment.
- 7.3 Due to the potential difficulties in sourcing material, the possibility of introduction of contaminants and the difficulties associated with attempting to artificially achieve a desired ground level, recharging or backfilling is not the preferred option for this site.
- 7.4 The option for this project and agreed in consultation with SNH in July 2020, is the use of biodegradable structures to aid the natural accretion of sediments. There are several types of structure suitable for this approach including sediment fences (such as brushwood groynes) and/or biodegradable grids. The

purpose of these structures is to minimise wave action and slow currents, allowing the fine-grained fraction of the sediment, which is abundant in the Firth of Forth, to settle out.

- 7.5 Brushwood groynes generally consist of two parallel rows of untreated wooden stakes, normally at right angles to the foreshore, driven deep into the mud with willow brushwood used as infill between the stakes. Other types of biodegradable infill could be used but brushwood is the most typical. For sediment shores it is recommended that top of the groyne is 0.5m above the maximum profile (CIRIA 2020).
- 7.6 If the ground compression is not severe (less than 0.10-0.15m), or following the successful implementation of sediment fences to raise the ground level, biodegradable grids can be used to stabilise sediments and encourage faster vegetation recolonisation (Temmink, Christianen, Fivash, Angelini, Bostrom, Didden, Engel, Esteban, Gaeckle, Gagnon, Govers, Infantes, van Katwijk, Kipson, Lamers, Lengkeek, Silliman, van Tussenbroek, Unsworth, Yaakub, Bouma and van der Heide 2020). These grids are pinned throughout the affected area and the structure of the grids traps sediment and provides a framework for the root systems of saltmarsh vegetation to establish more quickly.
- 7.7 Planting or re-seeding is not proposed for this area. The Department for Environment, Food and Rural Affairs (Defra) and Environment Agency Saltmarsh Management Manual (Adnitt, Brew, Cottle, Hardwick, John, Leggett, McNulty, Meakins and Staniland 2007) recommends that where surrounding saltmarsh is present, the best approach is to allow natural re-colonisation. SNH confirmed in July 2020 that this is an acceptable approach in this area.
- 7.8 The Mean High Water Springs (MHWS) height at the location of the proposed scheme is 2.95m above ordnance datum (AOD). In areas above this height sediments accretion is expected to be slower than the lower shore and may result in the formation of saltmarsh pans (ponds). These are naturally occurring habitats on many saltmarshes.

Monitoring

- 7.9 Regular monitoring of the method employed to assist recovery of the saltmarsh will be required. This is essential to measure the efficacy of the mitigation and determine if any further interventions are required. Monitoring should be undertaken by suitably qualified personnel employed by the Contractor and any interventions should only be carried out after consultation with SNH.
- 7.10 An outline monitoring programme is detailed in Table 1.

Table 1: Suggested Monitoring Programme

| Monitoring Purpose | Frequency | Method | End Point | Potential Interventions |
|---|--|---|---|--|
| To monitor ground levels, ensuring sediment accretion is occurring. To monitor state of mitigation measures. | Monthly | Initial accurate measurements within one month of removal of the working platform using a surveyor’s level or similar and then visual measurement against fixed markers. Visual assessment of mitigation structures. | Ground levels have returned to those of the surrounding saltmarsh. Vegetation has begun to establish across the affected area. | Consideration of alternative structures or methods if sediment accretion is not occurring or erosion is evident. Maintenance of structures. |
| To monitor development of vegetation communities. | Twice per year (in late spring and late summer). | Using the fixed quadrats set-up for pre-construction surveys. Additional quadrats as required as | Stable saltmarsh vegetation communities have developed. | Seeding or transplanting if vegetation does not develop. |

| Monitoring Purpose | Frequency | Method | End Point | Potential Interventions |
|--------------------|-----------|---|-----------|-------------------------|
| | | new vegetation types develop. Vegetation to be recorded using standard NVC approach. | | |

- 7.11 In the immediate months following construction, monitoring will focus on recording sediment accretion to determine whether ground levels are rising as expected. The site should be visited by qualified personnel employed by the Contractor monthly or after a large storm event which may have dislodged sediment fences, measuring ground levels and keeping a written and photographic record. Fixed markers throughout the affected area may be beneficial and reduce the requirement for technical equipment. The state of any structures introduced to aid sedimentation should be visually assessed during each visit and, where required, maintenance should be undertaken. If monitoring determines that ground levels are not rising an alternative approach, such as recharging, may need to be considered in consultation with relevant stakeholders.
- 7.12 It is anticipated that following the first full growing season (spring and summer) after construction, some vegetation will be apparent on the site. Once vegetation has begun to establish, the focus of the monitoring will shift to recording the vegetation communities. Ground levels should still be monitored during this phase, but the establishment of vegetation will aid accretion and stabilise the sediment, and so visits need not be so frequent.
- 7.13 The approach for monitoring vegetation should follow the NVC protocol used for the pre-construction surveys and visits should be made at the beginning and end of the growing season (late spring and late summer) each year to capture the development of both annual and perennial vegetation. The same quadrat positions as the pre-construction surveys should be re-visited on each occasion, recording species presence and percentage cover at each location. This allows assessment of development of vegetation rather than potential variations across the site. Additional quadrat locations maybe be required where different vegetation stands have developed that are not covered by existing quadrat locations. The number of additional quadrats should be in multiples of five in each vegetation stand to facilitate the use of frequency data to create NVC compatible floristic tables.
- 7.14 Aerial imagery or LiDAR may also be useful tools for monitoring the early development of the saltmarsh, measuring both the topography and ground cover of the area remotely.
- 7.15 Monitoring should continue until stable saltmarsh communities have developed, i.e. two successive monitoring visits have recorded the majority of quadrats (>75%) to consist of mid or upper marsh communities as defined by Rodwell (2000). Annual or pioneer communities are not considered to be stable saltmarsh communities in this location. The Contractor will be responsible for the implementation of saltmarsh mitigation and for a period of monitoring until stable communities have developed. This is anticipated to take up to five years. Following the Contractor's input, remaining monitoring will be the responsibility of the trunk road operating company.

8 Reporting

- 8.1 The Contractor will prepare annual written reports for Transport Scotland (and statutory bodies as requested) to document the saltmarsh recovery process. The reports will include:
- information on the structures used to aid natural accretion, including material, number, and positioning;
 - botanical (quadrat) information including locations;
 - ground level details;
 - creek size and location; and
 - details of any maintenance required or changes to the approach.
- 8.2 The Contractor will also prepare a final written report for Transport Scotland (and statutory bodies as requested) to document the saltmarsh recovery process. The report will include a description of pre-construction conditions, mitigation measures employed during construction and a summary of post-construction monitoring. A final site map should be provided to Transport Scotland (and statutory bodies as requested) showing mapped saltmarsh communities and creek locations at the end of the monitoring period.

9 References

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