

Note / Memo

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Industry & Buildings**

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Copy:
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Classification: Project related

Subject: Dunbar East Beach, Northern Breakwater - Environmental note

1 INTRODUCTION

1.1 Background

Dunbar East Beach is located on the east coast of Scotland, approximately 40km east of Edinburgh and 30km north of Eyemouth. Dunbar Harbour is located to the immediate north of the frontage.

Historically, the frontage has enjoyed a full beach with a timber groyne on its southern boundary. In recent years, the timber groyne has fallen into disrepair, and the frontage is now largely characterised by a rocky shore platform that is predominantly absent of sediment cover, with a backing seawall. Following successive storms in 2014, the beach was almost entirely eroded and further storms in subsequent years left the frontage devoid of any sediment able to form a beach. The foundations of the wall have been exposed due to the loss of beach, as well as damage and several breaches of the wall due to storm wave impact. Some sand has returned to the frontage, however, works are required to retain this on the foreshore.

Mid-way across the shore profile is a Scottish Water sewer pipe, encased in a concrete box shell. This was constructed in the 1990s, initially around 1.5m below the crown of the sand but since around 2002, when beach levels dropped, it has stood proud of the shore. Whilst it is not necessarily felt that this structure has increased the tendency for beach loss during storms it is possible that now beach levels have dropped so notably, the structure inhibits the slow, progressive natural post-storm recovery by presenting a physical barrier to the return of sand from offshore to the upper beach. Works were undertaken to the sewer pipe in 2017, which comprised the placement of rock armour around the pipe, the intention of which was to 'smooth' the pipe, allowing the natural recovery of the foreshore. No change in sediment retention at East Beach has been identified following completion of these works and therefore further works are necessary.

East Lothian Council is proposing to implement the Dunbar East Beach Seawall Defence Project, in order to enhance the amenity value of the area whilst also providing coastal protection to the existing seawall. This scheme, which already has a marine licence from Marine Scotland (reference 07006/19/0) and planning permission from East Lothian Council (reference 18/01390/PCL), is proposed to encourage sediment to remain on the foreshore at East Beach providing both coastal erosion / flood risk and amenity benefits.

The consented scheme comprises the following elements:

- Construction of a breakwater at the southern end of East Beach.
- Refurbishment of an existing groyne at the southern end of Each Beach.

- Local placement of rock armour at the toe of the seawall (located above the level of mean high water and therefore these works are not included on the marine licence).

Due to the availability of additional funding, East Lothian Council is now proposing to supplement the above consented works with a further breakwater in the northern part of East Beach, referred to throughout this note as the Northern Breakwater.

Further detail regarding the proposed works is provided in Section 2.

1.2 Purpose of this report

Marine Scotland has confirmed that the addition of the Northern Breakwater into the scheme is a material change to the consented scheme, which will require a further marine licence application (rather than a variation to the existing licence).

The environmental assessment presented within this document has been submitted in support of the marine licence application for the Northern Breakwater.

2 DESCRIPTION OF PROPOSED SCHEME

The Northern Breakwater will be set with a crest level of around 3m above Ordnance Datum (OD), extending out across the line of the existing sewer pipe with the head of the structure allowing incorporation of the seaward manhole. There will be a localised low spot in the breakwater in the location of the existing encased sewer pipe; this low spot will allow passage through the structure for walkers, walking directly on the concrete encasement of the pipe. The structure will be constructed as far as possible using local rock, three to six tonne in size.

The structure will extend up to 30m offshore, providing direct protection to the corner of the existing defence in an area that has suffered damage in the past. The structure will provide protection over part of the northern section of the sea wall, with the potential to develop a higher beach in front of this section of the wall.

2.1 Description of construction works

It is envisaged that construction materials required to construct the Northern Breakwater (i.e. rock) would be delivered to site by road. The route to site would be discussed and agreed with the Contractor in advance of the works commencing.

Construction plant would gain access to the foreshore via the existing slipway at Dunbar Harbour, or via a new temporary access ramp that would need to be constructed at the southern end of the beach. If required, the new temporary access ramp would be constructed using stone or another suitable material, and would be located above the level of mean high-water springs. Any temporary access ramp required to support construction works would be removed in full on completion of the works.

It is predicted that the rock to be used to construct the proposed Northern Breakwater would be placed into position using tracked excavators with a grab. Given the presence of Scottish Water infrastructure on the foreshore, including sewer pipes and manholes, temporary protection may be necessary to avoid damage by construction plant when moving around the foreshore. Such protection, if required following liaison with Scottish Water, would be in the form of road plates or similar, placed locally to the route of plant within the works area.

2.2 Programme

As noted above, East Lothian Council has permission to construct a breakwater and refurbish an existing groyne at the southern end of the beach, and locally place rock armour at the toe of the seawall at the northern end. The marine licence for these works expires on the 31st May 2020. East Lothian Council's intention is therefore to construct these works prior to 31st May 2020, with construction of the Northern Breakwater being undertaken immediately after completion of these works (assuming the marine licence for the Northern Breakwater is received in time). Should this not be possible, the contractor would demobilise from site following completion of the consented works and return at a later date to construct the Northern Breakwater.

As works are proposed to be undertaken using land-based plant, access onto the foreshore will be tidally restricted (i.e. works will be undertaken at low tide or on an ebbing tide).

2.3 Environmental management measures to minimise the risk of pollution incidents during construction

As is the case for most construction works that take place in and near to the marine environment, there is the potential for accidental releases of substances which could result in pollution incidents, namely:

- Spillages of diesel, oils and chemicals from construction plant used during the works.
- Spillages of fuels directly or indirectly into the marine environment during re-fuelling.

The risk of a pollution incident occurring and impacting on the marine environment will be controlled through the implementation of the following measures:

- A spill kit (including booms for potential leaks directly into the marine environment) will be kept on site at all times during the construction works.
- Any major spills or leakages will be reported to the Scottish Environmental Protection Agency (SEPA).
- Works will adhere to best practice guidance and pollution prevention measures provided in the CIRIA Coastal and Marine Environment Site Guide (Second edition) (C744) and SEPA's Pollution Prevention Guidance.
- Work will only be taken on an ebbing or low tide.
- No equipment will be left within the intertidal environment outside of working hours.

With the implementation of the above measures, it is anticipated that the risk of a pollution incident occurring would be minimised as far as possible.

3 BASELINE ENVIRONMENT

3.1 Coastal processes

Two coastal erosion studies have been undertaken at Dunbar East Beach. Pontee (2006) determined that the beach had decreased since at least 1960, which coincides with the deterioration in condition of the timber groyne and the installation of Scottish Water sewerage pipes. Over the same time period, there has been a general increase in wind speeds and (since the mid-1980s) an increase in the frequency of winds from north-north-west to north-east directions. It appears that these changes have caused similar changes in the wave climate at East Beach. This could have produced an increased south-easterly (and possibly offshore) movement of material on East Beach, coupled with a decreased north-westerly movement. This would have produced a net loss of material from East Beach (Pontee, 2006).

The second study undertaken found that the frontage is exposed to a relatively high energy wave climate from the North Sea and a relatively high tidal range (4.4m on spring tides) (Royal HaskoningDHV, 2016). Given this exposure, sparse sediment cover over the rocky shore platform is to be expected. Due to the predominant wave direction being parallel to the shore, there is expected to be only low-to-modest alongshore transport of sediment in the inter-tidal zone. It is expected that during storm events, material (mostly sand) is drawn down the inter-tidal zone from the upper beach to the nearshore sub-tidal zone (below the low water mark). Once in the nearshore, tidal currents can, if sufficiently strong, transport the material (especially the sand fractions) parallel to the shore, before calmer conditions slowly and progressively bring the material back to the upper beach (Royal HaskoningDHV, 2016).

A summary of the hydrodynamic and sedimentary regime at Dunbar is provided below.

3.1.1 Water levels

Mean High Water Spring (MHWS) water level for Dunbar is at 2.5m Ordnance Datum (OD), with Mean Low Water Spring (MLWS) level of -1.9m OD, giving a spring tidal range of 4.4m.

Extreme water levels as reported in the Environment Agency's boundary conditions report are:

- 1 in 1 year (T1) = 3.25m OD
- 1 in 100 year (T100) = 3.74m OD

3.1.2 Tidal currents

There are no direct measurements of tidal currents local to the area. However, observations made during site inspections have revealed that tidal flows across the area are low.

3.1.3 Wave conditions

The dominant wave direction at Dunbar East Beach is from the north-east sector, with the frontage being orientated to this direction. The area is, however, exposed to waves between north, east and to a degree the south.

Typically, the main wave approach during major storms acts normal to the shoreline, with slight variation under different storm events as waves are affected by the wider rock outcrops over the lower foreshore. It has been reported (Pontee, 2006) that the present problem of beach lowering may be associated with a slight shift in the frequency of storm direction tending to result in an increased movement of sediment to the south-east.

3.1.4 Sediment movement

Research shows that the main movement of sediment in the area tends to be in the on-shore off-shore direction, with a slight tendency for sediment to be moved towards the south-east.

From observed evidence, the beach to the south-east of East Beach has remained relatively stable, with variation supporting the assessment that sediment is brought in and drawn down by different wave conditions.

Within the Lamer Street area, there has been movement of sediment from the main beach area, with the most significant loss at the northern end where waves interact with the sharp return in the alignment of the sea wall. Towards the southern end of this local frontage, some limited sediment is retained by the influence of the remains of the groyne close to the sea wall but predominantly due to the additional protection afforded by the local higher upper beach rock outcrop. As beach levels have dropped against the sea wall over the whole local frontage, this will have increased the potential for wave reflection, tending to accelerate draw down of beach sediment.

3.2 Designated sites for nature conservation

There are no sites designated for their nature conservation importance within the footprint of the proposed works. There are however sites designated for nature conservation in the surrounding area, as detailed below.

3.2.1 Firth of Forth Special Protection Area

The Firth of Forth Special Protection Area (SPA) is located approximately 500m north of the proposed scheme footprint. The Firth of Forth SPA is a complex of estuarine and coastal habitats in south east Scotland stretching from Alloa to the coasts of Fife and East Lothian. The site includes extensive invertebrate-rich intertidal flats and rocky shores, areas of saltmarsh, lagoons and sand dune.

The Firth of Forth SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species detailed in Table 1.

The site qualifies under Article 4.1 by regularly supporting a population of European importance of the Annex 1 species sandwich tern *Sterna sandvicensis* during the passage period (a winter peak mean during the five-year period 1993/94 to 1997/98 of 1,617 individuals, 6% of the GB population).

Table 1 Qualifying species of the Firth of Forth SPA (Article 4.1)

Species	Count (1993/94 to 1997/98 winter peak means)	% of the GB population
Red-throated diver <i>Gavia stellata</i>	90 individuals	2
Slavonian grebe <i>Podiceps auritus</i>	84 individuals	21
Golden plover <i>Pluvialis apricaria</i>	2,949 individuals	1
Bar-tailed godwit <i>Limosa lapponica</i>	1,974 individuals	4

The site further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species detailed in Table 2.

Table 2 Qualifying species of the Firth of Forth SPA (Article 4.2)

Species	Count (1993/94 to 1997/98 winter peak means)	% of population
Pink-footed goose <i>Anser brachyrhynchus</i>	10,852 individuals	6 (Eastern Greenland/Iceland/UK biogeographic population)
Shelduck <i>Tadorna tadorna</i>	4,509 individuals	2 (North-western Europe biogeographic population)
Knot <i>Calidris canutus</i>	9,258 individuals	3 (North-eastern Canada/Greenland/Iceland/North-western Europe biogeographic population)
Redshank <i>Tringa totanus</i>	4,341 individuals	3 (Eastern Atlantic biogeographic population)
Turnstone <i>Arenaria interpres</i>	860 individuals	1 (Western Palearctic biogeographic population)

The Firth of Forth SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual waterfowl. In the five-year period 1992/93 to 1996/97 a winter peak mean of 95,000 individual waterfowl was recorded, comprising 45,000 wildfowl and 50,000 waders.

3.2.2 Firth of Forth Ramsar site

The Firth of Forth Ramsar site is located approximately 500m north of the proposed scheme footprint. The site qualifies under Ramsar criterion 5 (Assemblages of international importance: species with peak counts in winter: 72281 waterfowl (5-year peak mean 1998/99-2002/2003)) and criterion 6 (species/populations occurring at levels of international importance). These species are detailed in Table 3.

3.2.3 Firth of Forth Site of Special Scientific Interest

The Firth of Forth Site of Special Scientific Interest (SSSI) is located approximately 500m north of the proposed scheme footprint. The site is an extensive coastal area located on the east coast of Scotland. It stretches from Alloa to Crail on the north shore and to Dunbar on the south shore. It includes the estuary upriver from the Forth bridges and the firth east of the bridges. It is of importance for a variety of geological and geomorphological features, coastal and terrestrial habitats, vascular plants, invertebrates, breeding, passage and wintering birds.

Table 3 Qualifying species/population of the Firth of Forth Ramsar site as identified at designation

Species	Count (5 year peak mean 1998/9-2002/3)	% of population
Species with peak counts in spring/autumn		
Pink-footed goose, <i>Anser brachyrhynchus</i>	7863 individuals	3.2 (flyway population)
Common redshank, <i>Tringa totanus totanus</i>	5151 individuals	2 (flyway population)
Species with peak counts in winter		
Slavonian grebe, <i>Podiceps auritus</i>	68 individuals	2

Species	Count (5 year peak mean 1998/9-2002/3)	% of population
Red knot, <i>Calidris canutus islandica</i>	7295	1.6
Bar-tailed godwit, <i>Limosa lapponica lapponica</i>	1737	1.4

3.2.4 Barns Ness Coast SSSI

The Barns Ness Coast SSSI is located approximately 1.75km south of the proposed scheme footprint. The site contains a variety of coastal habitats including shingle and sandy shores, sand dunes and rocky stacks.

The succession of Lower Carboniferous Limestone, rich in fossils, allows correlation between the Scottish Lower Carboniferous and the Lower Carboniferous of Northumbria, hence is of considerable importance. At Barns Ness an almost complete, though heavily faulted, section through the whole lower limestone group is exposed. The dissected raised beach platform on the foreshore at Broxmouth is of geomorphological interest.

The mineral enriched dune grassland, beach-head saltmarshes and shingle are of particular interest as examples of very uncommon habitats in the Lothian area. The grassland contains an exceptionally diverse range of wild flowers, with species such as purple milk-vetch *Astragalus danicus*, restharrow *Ononis repens* and red and white campion (*Silene dioica* and *S. latifolia*). The site as a whole supports a number of locally rare plant species, including sea milkwort *Glaux maritima*, saltmarsh rush *Juncus gerardii*, crested hair-grass *Koeleria macrantha*, yellow horned-poppo *Glaucium flavum*, sea arrow-grass *Triglochin maritimum*, sea meadow-grass *Puccinellia maritima* and various sedges such as sand sedge *Carex arenaria*, distant sedge *Carex distans* and long-bracted sedge *Carex extensa*.

The diversity of birds, butterflies, day flying moths and invertebrates also add to the interest of the site.

3.3 Habitat and species

The proposed scheme footprint is located solely within the intertidal, specifically an area of intertidal rock which was formerly covered in sand. No species or habitats of conservation importance have been identified within the footprint of the proposed scheme, based on information available from Marine Scotland's Maps interactive tool (National Marine Plan interactive).

Given the recent natural reduction in intertidal sand from the area, it is anticipated that any benthic communities within the intertidal will be opportunistic or pioneer marine species of low conservation value.

3.4 Water quality

3.4.1 Water Framework Directive

The proposed scheme is located within the North Berwick to Barns Ness coastal waterbody (ID: 200467). This waterbody was classified as Good in 2016.

3.4.2 Bathing Waters

The proposed scheme is located within the Dunbar (East) Bathing Water (EC bathing water ID number: UKS7616018). The site has been classified as 'Good' for both the 2016/17 and 2017/18 bathing waters seasons.

4 POTENTIAL ENVIRONMENTAL IMPACTS

4.1 Coastal processes

Changes to coastal hydrodynamics

The proposed scheme is located at the coastal margin and therefore, there is potential for the proposed scheme to interact with the existing hydrodynamic and sedimentary processes.

The proposed Northern Breakwater would provide protection to the exposed corner of the existing sea wall. Waves would be prevented from running along the return face of the wall back towards the Lamer Street sea wall. Locally, this would remove wave concentrations in the northern corner, reducing the wave reflection and potential overtopping, the intention of which is to retain sediment and hence beach levels along the northern section of Lamer Street. The principal effect on coastal processes will therefore be an intended one, namely reducing the wave energy acting upon the intertidal and thereby encouraging sediment to retain on the foreshore at East Beach.

The presence of the Northern Breakwater would not reduce any potential for longshore movement more generally across the frontage.

Given the very small footprint of the proposed scheme (approximately 0.15ha), the proposed scheme would have no significant effect on the coastal processes in the wider area beyond East Beach, with only a local influence predicted on sediment behaviour over the upper beach due to a reduction in wave activity / energy in the lee of the proposed structure.

4.2 Ecology

Direct impacts on intertidal ecology

The proposed scheme will result in direct impacts on intertidal ecology due to the proposed placement of rock armour on the foreshore (therefore covering up the existing ecological resource). The footprint of the proposed scheme is approximately 0.15ha and therefore this impact would be very small scale and highly located. In addition, the rock armour is to be placed directly on top of existing areas of intertidal rocky foreshore. This, in addition to the highly localised nature of the proposed works results in a conclusion of no significant adverse impact to the existing habitat.

In addition to the above, the proposed movement of construction plant and personnel across the foreshore, and installation of temporary works, if required (i.e. access ramp and protection to Scottish Water infrastructure) has potential to impact on the existing intertidal ecology. However, as noted in Section 3, no species or habitats of conservation importance have been identified within the footprint of the proposed scheme or within the working area. In addition, the working area is predicted to be relatively localised around the proposed scheme footprint, and any temporary works required would be highly localised and removed in full on completion. Based on the above, no significant impacts are predicted due to the movement of construction plant and personnel along the foreshore, as well as the installation of temporary works required to support the construction phase.

The aim of the proposed scheme is to encourage sediment to remain on the foreshore at East Beach providing both coastal erosion / flood risk and amenity benefits. Assuming the proposed scheme is successful, the works would reinstate the lost intertidal sandy habitat. A more stable intertidal sandy beach has potential to result in ecological benefit to the area.

As noted in Section 2, there is potential for pollution incidents to occur during the construction phase, which could indirectly impact on the ecological resource. However, the best practice measures outlined in Section 2, and below, will ensure that the risk of a pollution incident from occurring will be minimised.

Indirect impacts on intertidal ecology

There is potential for indirect impacts to intertidal ecology outside of the proposed scheme footprint due to changes in the hydrodynamic and sedimentary regime. However, as detailed in Section 4.1, the proposed scheme is predicted to only effect coastal processes on a local scale. No wider scale adverse effects on coastal processes are predicted. As a result, no significant impacts to intertidal ecology in the wider area are predicted.

Mitigation measures

The only mitigation measures considered necessary beyond the in-build measures detailed in Section 2.1 are:

- The contractor will ensure that appropriate steps are taken to minimise any damage to the beach, foreshore and seabed during the works (as per Condition 9 of the existing marine licence for the consented parts of the East Beach scheme).
- The contractor will ensure that the beach, foreshore and seabed is returned to its original profile, or as close as reasonably practicable, following completion of the works (as per Condition 10 of the existing marine licence).
- The contractor will adopt suitable protection measures to ensure that the Scottish Water sewage infrastructure on the foreshore is protected during the construction works.

Residual impact

No residual impacts are predicted.

4.3 Water quality

Reductions in water quality

The proposed works have potential to reduce water quality via the following pathways:

- Spillages of oils and fuels.
- Placement of rocks onto the seabed causing disturbance to sediments.
- Damage to Scottish Water sewage infrastructure, potentially resulting in a pollution incident.

The construction works will only be undertaken during an ebbing or low tide which limits the risk of reductions in water quality. Also, the area is predominantly intertidal rock and therefore, it is concluded that the placement of rock onto the seabed would not result in unacceptable reductions in water quality through the resuspension of sediments. As noted above, temporary protection would be provided to Scottish Water's infrastructure during the works (if required following liaison with Scottish Water) to avoid damage by construction plant when moving around the foreshore. Such measures would ensure that damage to the infrastructure, and the potential for pollution incidents to occur in minimised as far as possible.

Mitigation measures

No mitigation measures are considered necessary beyond the in-build scheme design measures identified in Section 2.1 above (i.e. adherence to best practice measures with regard to construction works in the marine environment).

Residual impact

No residual impacts are predicted.

4.4 Noise and vibration

Construction related noise disturbance to birds

There is potential for heavy machinery and construction works to cause disturbance to local bird populations. However, there are no designations for protected bird populations within the footprint of the proposed scheme and there are no 'noisy' activities required (i.e. activities such as piling or the use of explosives).

The Firth of Forth SPA, Ramsar site and SSSI is located approximately 500m to the north of the proposed scheme footprint, and therefore, the potential exists for noise from construction works to impact these sites. However, the operational Dunbar Harbour is located in-between the proposed scheme footprint and the designated sites, and therefore noise from the proposed scheme will be screened by ongoing activities at the harbour. Given the nature of the proposed works, it is considered that construction related noise would not be considerably above the existing background levels. In addition, any disturbance would be temporary only whilst the construction works are ongoing. Based on the above, no significant impacts to birds within the Firth of Forth SPA, Ramsar site and SSSI are predicted due to noise disturbance.

Construction related noise disturbance to humans

As well as ecological receptors, construction related noise disturbance has potential to impact on the residents adjacent to the proposed works area. Increased traffic associated with the works and movement of plant is expected to create noise disturbance effects. As noted above, the proposed construction works will be short term, and therefore any disturbance would be temporary only. In addition, the majority of works will be undertaken on the foreshore at a lower elevation from residential properties, and therefore significant noise disturbance to residents is not predicted.

Mitigation identified

Although significant construction related noise disturbance impacts are not predicted, the following best practice measures are proposed:

- Informing local residents about the construction works well in advance.
- Avoiding operating particularly noisy equipment at the beginning and end of the day.
- Using the most modern equipment and ensuring equipment is appropriately maintained.

In addition to the above, the contractor would ensure that rocks are placed during construction of the breakwater, rather than being dropped into position, which will further minimise the risk of noise disturbance to the sensitive noise receptors.

Residual impact

No residual impacts are predicted.

5 CONCLUSION

This assessment has illustrated that the short term and temporary adverse impacts predicted to occur during construction can be mitigated to acceptable levels by following standard guidance and best practice measures.

The works are intended to provide beneficial impacts during the operational phase, by increasing the amenity value of the beach and providing an increased level of coastal protection to the seawall.

6 REFERENCES

CIRIA (2010). The use of concrete in maritime engineering - a guide to good practice (C674). [Online] Available at: <http://www.ciria.org/ItemDetail?iProductcode=C674&Category=BOOK>

Pontee, N. (2006). Causes of beach lowering at Dunbar, Eastern Scotland, UK. Proceedings of the Institution of Civil Engineers - Maritime Engineering, 159(4), pp.157-166.

Royal HaskoningDHV. (2016). Dunbar East Beach Coastal Management and Groyne Reinstatement Engineering Advice. Report to Dunbar Shore and Harbour Neighbourhood Group.