
Staites Coastal Strategy

Appendix K

Technical Report #4 – Environmental Opportunities Assessment

1. Background

Research has shown that engineered rock armour structures such as those found protecting Staithes Harbour, tend to lack optimal habitat conditions for intertidal species, with a lack of surface texture variation (surface heterogeneity) and water retention the principal negative factors resulting in low diversity.

The Runswick Bay Coastal Protection Scheme constructed in 2018, incorporated techniques for environmental enhancements which may be considered viable at Staithes.

2. Runswick Bay Coastal Protection Scheme

The scheme comprised installation of 9,000 tonnes of imported granite rock armour to form a rock fillet protecting the toe of an existing seawall.

The engineered rock structure was modified to provide environmental enhancement through improved textural complexity and water retention by the creation of 70 artificial rock pools (typically 300mm in diameter and 150mm deep) and 130 grooved areas within the granite rock armour, at the time the largest application of this technique in the UK. The positioning of the distressed rocks in terms of the tidal pattern adds to the intrinsic value of the artificial rockpools. It is important that the rockpools are refreshed during the tidal pattern, and a variety of positions helps to create a mosaic of pool habitats.

The approach involved a drilling subcontractor working on site between tides and using simple equipment (circular saw and breaker powered from small electrical generator) to break out and score selected rocks in the completed revetment (based on elevation and orientation).

The enhancement created intertidal habitat otherwise absent from the structure and post construction monitoring has shown an increased species richness and diversity in the pools and grooves compared to un-enhanced areas of rock armour. The rock pools provide valuable functions for spawning, nursery and feeding for coastal species.

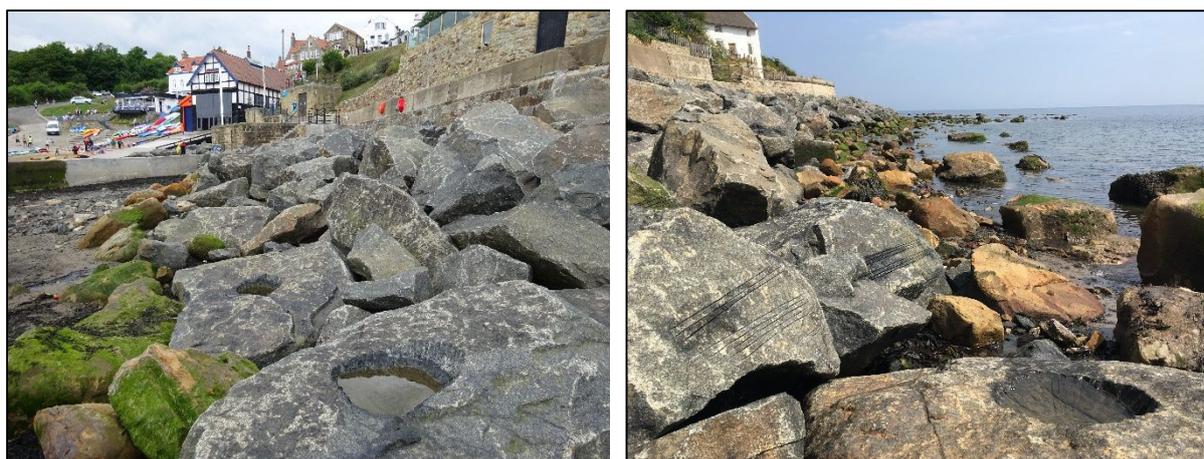


Figure 1 Examples of artificial rock pools and grooves in rock armour on completion of works

3. Application at Staithes

The coastal defences at Staithes include several rock armour elements which could accommodate retro-fitted surface enhancements similar to those installed at Runswick Bay.

As the rock armour has now been in place for over 14 years, the surfaces of the existing rock in the intertidal zone is generally well weathered and appears to provide some suitable habitat for intertidal species. During the coastal defences walkover survey in September 2019, marine fauna (including barnacles, winkles and whelks) were observed on the rocks, exploiting areas with rougher surface texture either naturally occurring/weathered or as a result of quarrying operations (charge holes, scores/grooves from handling/transport), and also spread more generally across the rock surfaces.

Providing textural enhancement is likely to provide additional habitat, however it may not create as significant an impact as when applied to more recently quarried granite which is slow to weather and smooth. Features which aid with water retention such as artificial rock pools are likely to provide greater benefit than surface scoring. The suitability and design of any enhancement scheme would need to be informed by a more detailed ecological assessment of the wider coastal area and the likely target species.



Figure 2 Examples of fauna observed during Staithes coastal defences walkover (September 2019).

4. Key Practical Considerations

4.1 Access

Access is required for operatives and equipment to rock within the intertidal zone.

The ramp at the western end of the north breakwater provides pedestrian access to the rocky foreshore and the rock toe along the northern face of the structure during low tide. The western extent (roundhead) and southern face are not accessible from foreshore at any stage of the tide.

Steps at the southern extent of the south breakwater provide pedestrian access to the rocky foreshore and the rock toe along the eastern face during low tide. Access is also possible around the northern extent of the structure during low tide however the foreshore material is very soft and difficult to traverse.

Whilst access to the majority of the length of toe of rock structures is possible from the foreshore at low tide, the height of the crest of the toe rocks remains a minimum of 1m and therefore it is not straightforward to safely access the intertidal working areas. Working only from the foreshore will significantly limit the number of rocks which can be accessed/worked on.

4.2 Working on rock armour

Whilst possible to form pools and scoring using relatively small (manually handled) equipment, the surfaces of the rock structures present difficulties for access and working conditions (working at height on uneven, slippery, potentially unstable surfaces containing significant voids). Developing a safe system of work may include lifting plant or working platforms which will need to be appropriate to mobilise and demobilise between tides and via existing pedestrian access routes.

Access to the rock may be possible from the crest above, however there will be negligible benefit to adding rock pool features above the intertidal zone and accessing the lower intertidal zone via traversing the upper structure would be hazardous.

4.3 Health and Safety

During the works, considerations associated with breaking out and cutting of rock include manual handling of equipment (consider lighter tools powered by separate generator), Hand Arm Vibration Syndrome (HAVS) (consider use of low vibration tools, monitor trigger time etc) and production of noise/dust (consider dust suppression, PPE etc), flying debris (consider exclusion zones, PPE etc). Working in close proximity to the existing cliffs may expose operatives to falling rock (potentially increased risk due to vibrations associated with works).

On completion of the works, members of the public (particularly children) may be attracted to investigate the contents of the rockpools. This could expose them to hazards associated with traversing rock armour (slips/trips/falls, crushing, entrapment in voids combined with rising tides, difficulty in affecting rescue etc) and rock fall if in close proximity to cliffs.

4.4 Integrity of Rock

Whilst the size of the typical feature on the rock armour is small compared to the volume/mass of the unit, there is a risk that works could introduce weaknesses into a rock and potentially a local defect which may affect the design life of the structure. Care is required to identify appropriate rocks and mitigate such risk.

5. Costs

The cost of the environmental enhancement works at Runswick Bay can be approximated to £80 -100 per rock pool based on two operatives working on daily rate and allowing for working and access/egress at suitable stages of the tide (approximately five-hour window per day). The more straightforward surface scoring was carried out concurrent with the rock pool installation and can be included within these costs.

6. Recommendations

Natural colonisation by marine flora and fauna evident on the surface of the imported rock armour throughout the intertidal zone suggests limited opportunities to gain benefit from environmental enhancement techniques focussing on distressing the surface of the rocks. Greater enhancement opportunities are offered through creating artificial pools to retain water and providing additional habitat which is not currently present. The suitability and design (including position and elevation) of such pools should be informed by a more detailed ecological assessment.

Overcoming the access and health and safety aspects associated with these techniques is likely to make installation activities more onerous and increase costs. Additionally, the potential introduction of new hazards to members of the public will be a key consideration for the local authorities.