Shoreham Adur Tidal Wall habitat survey report 2019-2024

This is a report issued by the University in fulfilment of Environment Agency – University of Brighton collaborative agreement. It pertains to 2019 to 2024 findings at Shoreham Adur Saltmarsh, providing an assessment of habitat conditions in association with works on reaches E2, W3, W4, W6 and W7

A report to the Environment Agency

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Executive summary

Planning conditions for Shoreham Adur Tidal Walls (SATW) flood risk management scheme included:

- Planning condition 7 (AWDM 1614/15) stipulated that the scheme should provide 1.32 hectares of compensatory intertidal (saltmarsh and mudflats) habitat in Reach W7.
- In Reach W7 (Shoreham Airport embankment) a "transfer of site control", further to Environment Agency (EA) works, was given to New Monks Farm developer (NMF) for the delivery of the Archimedes screw pumping station. This occurred after the completion of the SATW embankment at the airport in 2019. The portion of the Environment's Agency 1.32 ha intertidal habitat compensation area transferred to the NMF development was 770 m^2 (as reported in Jul 17 General Agreement Drawings, the Ash Partnership (2018)). When considering the area ceded to the subsequent New Monks Farm development, the Environmental Agency must demonstrate the creation of 1.243 ha of compensatory intertidal habitats (1.32 ha - 0.0770 ha = 1.243 ha) in Reach W7.
- Condition 10 of AWDM1614/15 stipulated that monitoring is required both prior to and post placement of protective matting, to ensure that SSSI habitats re-establish upon completion of works in each relevant section. The habitat should be allowed to re-establish naturally. The use of aerial images from the Channel Coastal Observatory (CCO) was used to monitor the extent of the reaches prior to and post SATW works on reaches E2, W3, W4 and W6. Visual assessments suggest that saltmarsh areas within the Estuary have recovered to pre-SATW works levels.
- Recovery of saltmarsh affected by the SATW works within the Estuary.

New Monks Farm erosion (NMF)– Comparative analysis of aerial photographs between 2016 and 2024 revealed significant erosion along both the northern and southern creeks near the NMF Archimedes screw pumping station. These creeks have experienced considerable deepening and widening over time. If erosion continues at this rate, it could lead to further loss of the SSSI (Site of Special Scientific Interest), potentially even threatening the integrity of the pumping station. This erosion poses the most urgent threat to the W7 reach, and immediate action is needed to prevent further damage. If left unchecked, it could gradually impact the saltmarsh ecosystem.

Status of Reaches E2, W3, W4 and W6 – W-walkover surveys were undertaken in 2020, 2021 and 2022, between June and September to monitor changes over 3 full year post SATW works. Visual assessment using ortho-rectified photography from Channel Coastal Observatory, shows overall growth in saltmarsh habitat between 2016 (prior to SATW works) and 2022 (3 full years post-delivery of SATW works), demonstrating positive successional processes in response to the SATW works. The final walkover surveys conducted between June 2022 and September 2022 reveal varying conditions across Reaches E2, W3, W4, and W6.

Reaches E2 and W3 are in poor condition primarily due to constraints and disturbances such as boat activity, while W4 and W6 exhibit a mix of fair to good conditions. Despite challenges, there are positive signs of growth and expansion in some areas, indicating resilience. Remediation actions are suggested for specific issues, such as exposed geotextile in W6, while natural recovery is expected in other cases, highlighting the ongoing progress and resilience of the marshes.

Vegetation changes in Reach W7 (established and newly created intertidal habitat)

The **total area of new intertidal habitat** created as part of the SATW compensation scheme has been manually digitised at 1:200 scale following the break of slope between the embankment and the intertidal area, indicated by a flatter slope and change in vegetation type. The total area of new intertidal habitat is **1.29 ha** this is marginally below that specified in planning conditions 7 (1.32 ha). The portion of the Environment's Agency 1.32 ha intertidal habitat compensation area transferred to the NMF was 770 m^2 (as reported in Jul 17 General Agreement Drawings, the Ash Partnership (2018)). When considering the area ceded to the subsequent New Monks Farm development, the Environmental Agency must demonstrate the creation of 1.243 ha of compensatory intertidal habitats (1.32 ha - 0.0770 ha = 1.243 ha) in Reach W7. **When being considerate of this "transfer of site control" the Environment Agency has created 0.0570 ha more intertidal habitat than specified in planning condition 7.**

Vegetation surveys in the form of quadrats located along transects have been carried out annually in Reach W7 to assess the development of the intertidal habitat creation site and established marsh in this reach. Established saltmarsh appears to have recovered from any impact occurring during the removal of the tidal wall, however the footprint of the old tidal wall remains unvegetated and compacted as it is still used as a footpath at low tide.

In the newly created intertidal habitat, surveys have demonstrated clear successional development on the site, with the initially high cover of annual pioneer species (*Suaeda maritima* and *Salicornia europaea* agg.) largely replaced by perennial species (*Puccinellia maritima* and *Atriplex portulacoides*). Frequency and abundance of the constant species *Puccinellia maritima,* annual *Salicornia species and Suaeda maritima* suggest that the initial plant community in the new marsh resembled SM10 transitional low marsh vegetation. Species of later successional stages appeared in 2024, although they were locally abundant.

The composition of the established vegetation in the upper zonation of saltmarsh remained relatively unchanged over the course of the monitoring period. It still resembles a **SM14a *Atriplex portulacoides saltmarsh community*** and can be found between the upper zonation of saltmarsh, **SM24 *Elytrigia atherica*** saltmarsh community and the **SM12a *Asteretum tripolii***.

The lowest area of the saltmarsh appeared to have recovered from any disturbance activity indicated by a decrease of bare ground and a rapid expansion of *Puccinellia maritima*. The community remains **SM12a *Asteretum tripolii* saltmarsh community**.

1. Background

1.1. The Shoreham Adur Tidal Walls project – SATW

The Shoreham Adur Tidal Walls project (SATW) proposed the improvement of 7.2km of sea defence of which 5km are located on the West bank of the River Adur and the remaining on the East bank (planning permission AWDM1614/15). Works included modifications of existing sea defences adjacent or within the saltmarshes of the Adur estuary to protect the town of Shoreham by Sea, West Sussex, against 21st Century Sea level rise. Engineering was designed under UKCP2009 protocols (as standard against which sea level rise is calculated nationally). A five-year monitoring project by the University of Brighton on behalf of the Environment Agency was conducted in fulfilment of Conditions of Planning for SATW that required the establishment of functional saltmarsh and remediation of any significant failure to establish (based on the design being optimal for a 50-year sea level rise period based on UKCP09).

The SATW scheme was delivered between 2016 and 2019, and this report summarises saltmarsh monitoring that has been carried out in the estuary between June 2019 and July 2024 by the University of Brighton. This monitoring aimed to assess the development of the intertidal habitat creation site located in the W7 reach between 2019 and 2024, and measure the response of existing saltmarsh in the estuary to the SATW project in reaches E2, W3, W4, and W6 (Figure 1) between 2020 and 2022.

Recovery of reaches W3, W4, W6, W7, and E2 (Figure 1) was required to be shown through this monitoring commission (further to adjustments agreed with Natural England). The period monitored to satisfy the conditions of demonstrable recovery pertaining to reaches, other than W7, was 3 years (2020-2022 inclusive); for W7 this was 5 years (2019-2023 inclusive, to be extended if necessary).

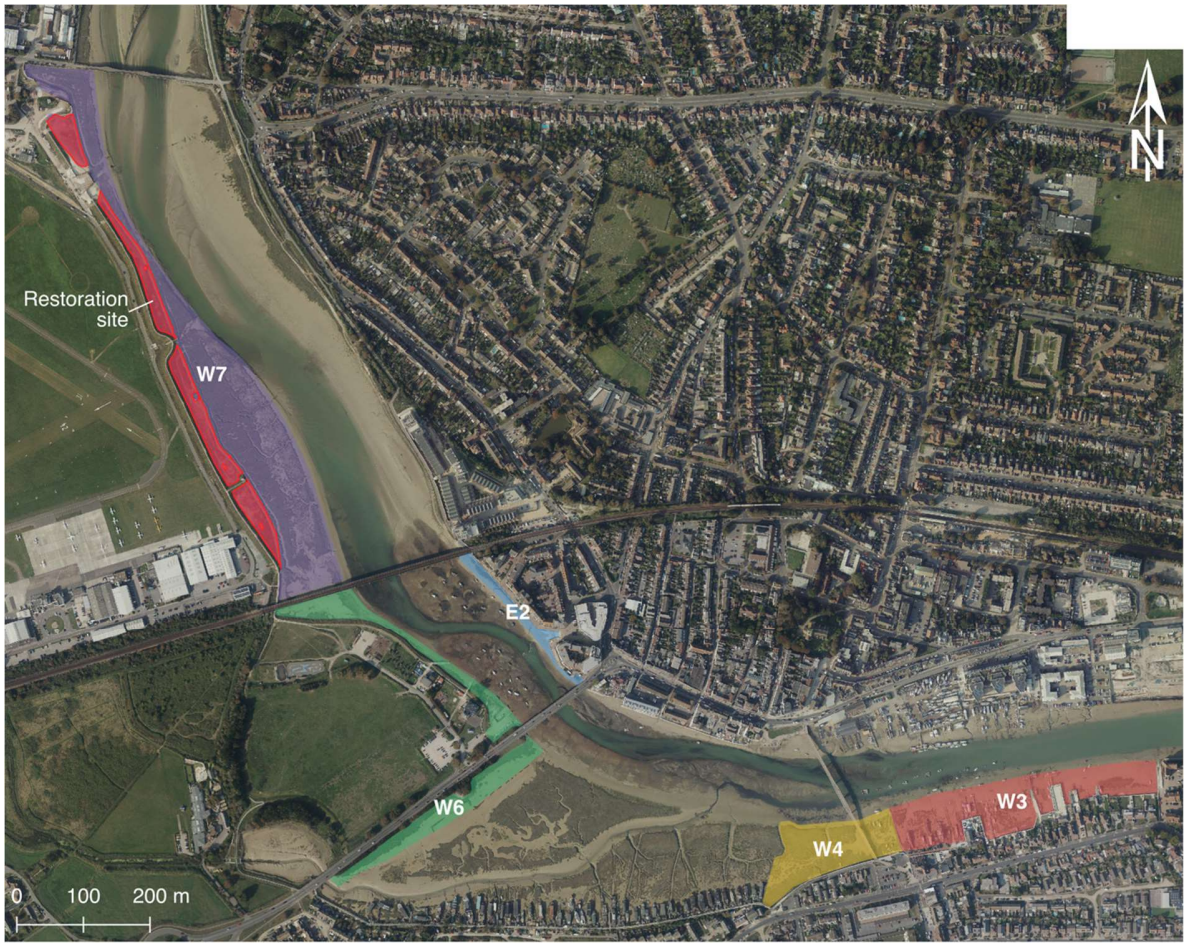


Figure 1:Location of reaches in the Adur estuary. The location of the restoration site (proposed saltmarsh habitat creation site of 1.32ha) is highlighted in red within W7 (the previous embankment was moved inland). Basemap: Aerial imagery is courtesy of the Channel Coast Observatory (www.channelcoast.org) and was taken on 20/09/2020

The Adur estuary contains a regionally significant area of saltmarsh, which has been recognised in its designation as a Site of Special Scientific Interest (SSSI), which is a designation of national importance. A portion South of the A259, is also an RSPB reserve (Figure 2Figure 2). Areas of this saltmarsh were impacted during engineering works as part of the SATW scheme. To compensate for this, as well as future losses caused by coastal squeeze, a 1.32 ha creation site was proposed to be created in the W7 reach of the estuary (West-adjacent Shoreham or Brighton City Airport) and has been monitored to evaluate the ecological development (Shoreham Tidal Walls NVC habitat Survey report, Environment Agency and Mott MacDonald 2015).



Figure 2: Location of the RSPB reserve in the Adur estuary. Data source: RSPB. Base map: Bing.

1.2. New Monks Farm

In Reach W7 (Shoreham Airport Adur embankment) a "transfer of site control" further to EA works was given to New Monks Farm (NMF) developer. This occurred after the completion of the SATW embankment at the airport in 2019 so that the northern section of the EA's scheme (north of the culvert at the mid-section of the airport embankment toward Ricardos and the wooden toll bridge) fell under new construction outcomes of that development. Site control was transferred to the development known as "New Monks Farm", after its successful appeal to win planning permission. This was subsequent to the completed delivery of the SATW intertidal habitat creation. The New Monks Farm Planning Permission also required, "outcomes," of saltmarsh habitat creation, part of which comprised an area of new saltmarsh alongside the saltmarsh area delivered under the SATW Planning Permission. The NMF saltmarsh restoration site is situated upstream of the New Monks Farm Archimedes screw, between the Archimedes screw and the wooden footbridge immediately north of it (Figure 3).

The NMF development installed a triple Archimedes screw and adjacent pumping station and engineered channels at the north section of the embankment adjacent to the airport (W7) and removed saltmarsh to reconfigure associated seawall defences (adjacent 2 heritage pillboxes) (see

area of intertidal habitat lost in Figure 3). From the 1.32 ha, the Environment's Agency SATW transferred 770 m^2 of intertidal area to the NMF development (as reported in Jul 17 General Agreement Drawings, the Ash Partnership (2018)). When considering the area ceded to subsequent New Monks Farm development, the Environmental Agency must demonstrate the creation of 1.243 ha of compensatory intertidal habitats (1.32 ha - 0.0770 ha = 1.243 ha) in Reach W7 (Figure 3).

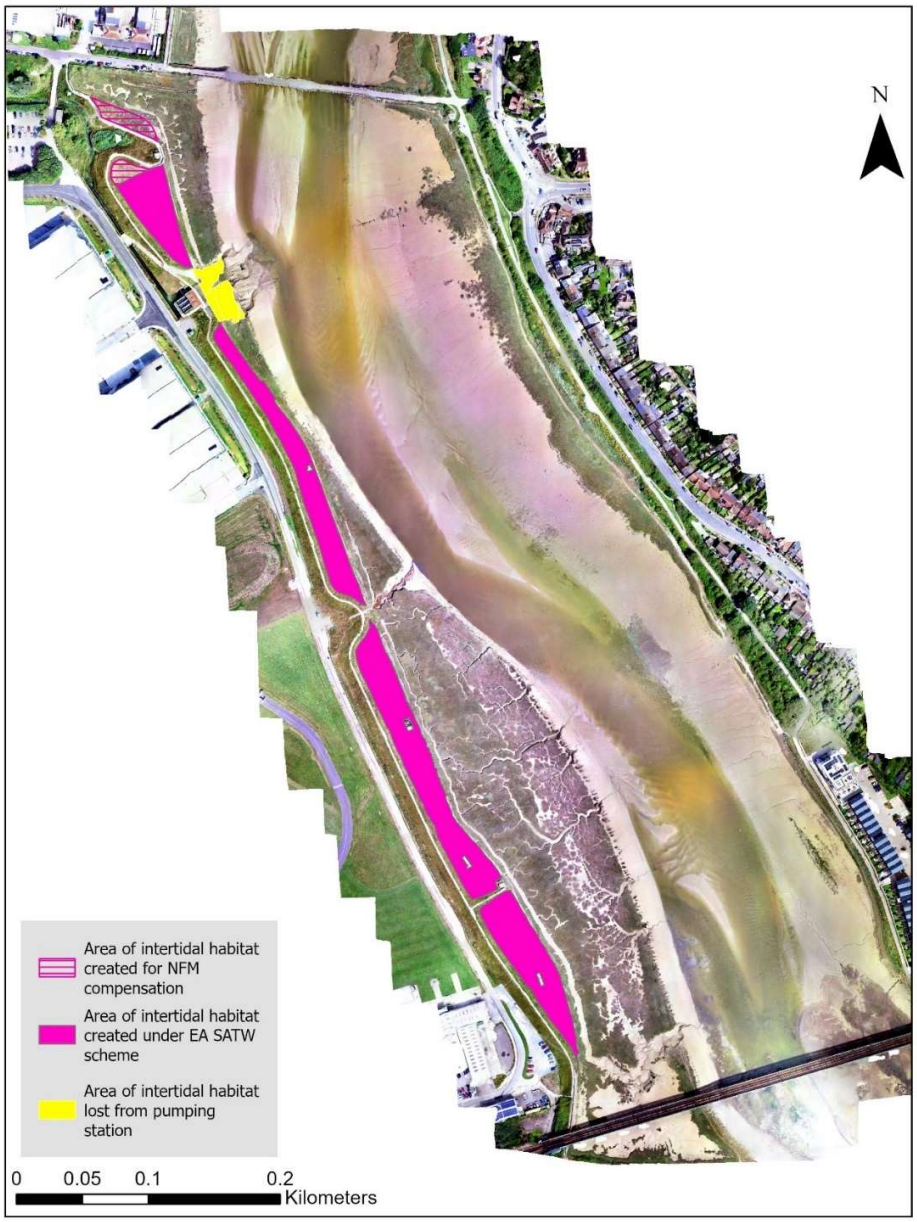


Figure 3: Intertidal habitats created as compensatory habitat by the EA SATW scheme and the new compensatory area for the NMF Archimedes screw. Basemap is from images captured by drone flights in 2024 combined and georeferenced.

NMF has agreed a separate habitat creation and timeline to recovery with Natural England and the local planning authority (LPA). The portion of marsh further delivered by NMF for agreement of planning of the design as "additional" to that loss was 0.084 ha (840 m^2). **The EA is consequently responsible for delivery of 1.243 ha and the total for the scheme is 1.327 ha (SATW and NMF compensation)**. The recovery is managed by NMF (under planning conditions) and demonstrable to Natural England and its statutory consultees.

In relation to the Environment Agency, outcomes must demonstrate integrity of those elements to which the Environment Agency is accountable.

Although this report and the agreement to monitor W7 relates to damages occurring at and around the New Monks Farm Archimedes screw and pumping station between June 2020 and present (June 2024) the disturbance and erosion at the Archimedes screw, does not relate to the works for which the Environment Agency is accountable. Saltmarsh erosion observed during the survey period was contained with the area ceded to the NMF pumping station (Figure 3), further monitoring is recommended to ensure that erosion is not expanding across the saltmarsh area.

The saltmarsh within the zone handed over to NMF development area is damaged by erosion, however this does not relate to the SATW scheme. Erosion creep from the Archimedes screw area to adjacent saltmarsh (both old and new saltmarsh) is assessed as occurring as a result of the Archimedes screw installation. It is progressive in nature.

2. Methodology

This section summarises the methodologies used to assess the habitat prior to and post the delivery of the SATW scheme.

2.1. NVC Habitat baseline surveys

Mott MacDonald Ltd. was appointed by the EA to undertake botanical surveys of grassland, scrubs, reed bed and saltmarsh habitats at Reaches W4, W7 and E3 for the Shoreham Adur Tidal Walls scheme.

The vegetation was surveyed on 28th May and 17th June 2015 following the methodology from the NVC Grasslands described by Rodwell *et al.* (1998). A total of 117, 2 m by 2 m quadrats were surveyed across the sites. All species were identified, Domin and percentage abundance values were assigned (Table 1). Each stand of surveyed grassland and saltmarsh vegetation was assigned to a community and sub-community using NVC guidelines and the software package, the Modular Analysis of Vegetation Information System (MAVIS) (CEH, 2000).

Table 1: Categories for the NVC frequency, NVC cover scale, and DAFOR scale

NVC frequency scale		NVC Domin scale for abundance		DAFOR scale (CSM)
I	1 - 20%	1	with few individuals <4%	**Dominant:** species appears at most (>60%) of the stops and it covers >50% of each sampling unit
II	21- 40%	2	with several individuals <4%	
III	41 - 60%	3	with many individuals <4%	
IV	61-80%	4	4 -10% cover	
V	81-100%	5	11 - 25%	
		6	26 - 33%	**Abundant**: species occurs regularly throughout, at most (>60%) stops and its cover is <50% of each sampling unit
		7	34 - 50%	
		8	51 - 75%	
		9	76 – 90%	
		10	91-100%	
				Frequent: species recorded from 41-60% of stops
				Occasional: Species recorded from 21-40% of stops
				Rare: species recorded from up to 1-20% of stops

2.2. Monitoring of Vegetation structure and composition

2.2.1. Reaches E2, W3, W4, and W6

At each reach, E2, W3, W4 and W6, structured walks (W shaped walk) were used to assess vegetation structure, vegetation composition and negative indicators (e.g. trampling, loss of vegetation, erosion) for each saltmarsh zone, with a least 10 stops within the site.

In July 2020, June 2021 and September 2022, three years following the SATW schemes implementation, structured walk ("W" shape) were used to assess general vegetation structure, vegetation composition and negative indicators (e.g. trampling, loss of vegetation, erosion) within the W3, W4, W6 and E2 reaches, the location of which are shown in Figure 4. Along the walk, at least 10 stops were made within the area, and at each vertex and midpoint of the W, a 2m by 2m quadrat was used to assess the presence and percentage cover of the species within the quadrat. Location of the individual quadrats for each reach can be found in Appendix 2.

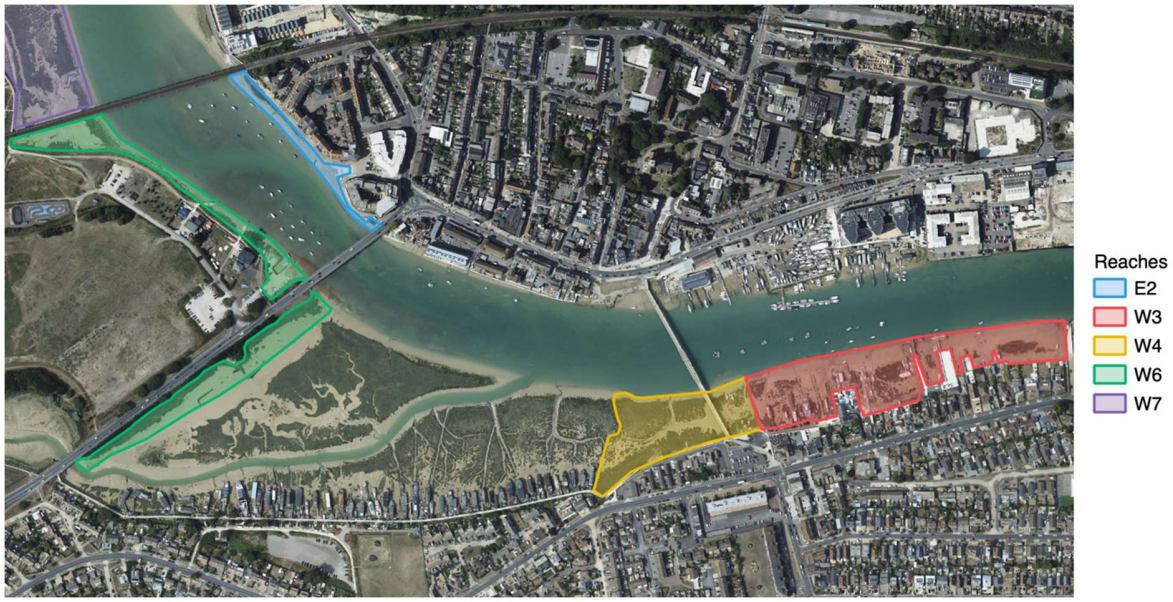


Figure 4: Location of the reaches surveys in the Adur Estuary. Only reaches E2, W3, W4, and W6 were surveyed with the W-walk. Basemap: Aerial imagery is courtesy of the Channel Coast Observatory (www.channelcoast.org)

2.2.2. Reach W7

Annual monitoring was set up in reach W7 in 2019 following the completion of the managed realignment as compensatory habitat provision for the SATW scheme and following the recommendations by Mott MacDonald (September 2015). A total of eleven transects were established and for each transect, one 2m by 2m quadrat (fixed point NVC survey) was placed in each of the identified homogenous stands of vegetation. Transects were located from the strandline to the lowest continuous saltmarsh area and three homogenous vegetated stands were identified:

- New saltmarsh – compensatory habitat created through the SATW scheme.
- Upper marsh: species-poor salt marsh community dominated by Sea-purslane (*Atriplex portulacoides)*
- Lower marsh: continuous area of marsh furthest from the strandline, with abundant and constant Salt-marsh grass (*Puccinellia maritima)* and Sea aster *(Tripolium pannonicum*)

A total of eleven quadrats per homogenous vegetation stands were used to monitor the plant communities. All quadrats were located in the field using GPS and visited annually in June-July between 2019 and 2024 (Figure 5). For each quadrat vegetation composition was recorded, where bare ground, plant litter, and all plants species present were identified, and abundance was visually estimated using percentage cover Vegetation structure was recorded by measuring five representative vegetation heights in cm and negative indicators such as *Spartina spp*. were also noted.

The survey data was used to analyse changes in abundance cover and the vegetation of the new saltmarsh was assigned to a community and sub-community using NVC guidelines and the software package, the Modular Analysis of Vegetation Information System (MAVIS) (CEH, 2000) for 2019 and 2024.



Figure 5: Location of transect and quadrats in W7, used for monitoring vegetation between 2019 and 2024. Basemap is from images captured by drone flights in 2024 combined and georeferenced.

Note that species named in this report follow the newest edition of Stace (2019) and plant communities are named following the National Vegetation Classification (Rodwell et al, 2000)

2.3. Method for monitoring extent changes

Changes in saltmarsh extents were monitored in four reaches (E2, W3, W4, and W6) to assess the impacts of the SATW works (condition 10). This was performed using Ortho-rectified aerial photography (Red, Green and Blue) from the Channel Coastal Observatory dated: 23rd July 2016, 15th September 2020 and 14th August 2022. Each image was exported in ArcGIS Pro 3.4.2 to visually assess the extent of saltmarsh areas in the four reaches

Extent in reach W7 followed a similar approach. For 2016, ortho-rectified aerial photography (Red, Green and Blue and False Colour infrared) from the CCO database was used and for 2024, images captured during drone flights were combined and georeferenced. Each image was exported, and the extent of the vegetated saltmarsh was manually digitised in ArcGIS Pro 3.4.2. The area of intertidal habitat was manually digitised at 1:200 scale following the break of slope between the embankment and the intertidal area, indicated by a flatter slope and change in vegetation type.

3. Results & Discussion

3.1. Reaches E3, W4, W5 and W6

3.1.1. Habitat extent in Reaches E3 W4, W5 and W6

Changes in habitat extent in reaches E3, W4, W5 and W6 were assessed prior to and post to the SATW work using visual image assessment. Ortho-rectified aerial photography from the Channel Coastal Observatory from July 2016, September 2020 and August 2022 were used. Overall, there has been an increase in saltmarsh extent over this time scale, across the four reaches but this is uneven (

Figure 6), with reach W4 demonstrating the greatest expansion (Figure 7).

This increase in extents is the result of the expansion and coalescence of patches across the reaches. Over time, pioneer species growth has occurred between separate patches of vegetation which has caused them to form larger patches. Changes in extent between 2016 and 2022 can be seen for each reach in Appendix 3.



Figure 6:Loss of salt marsh adjacent to the sea wall in Reach W3 due to SATW works (showing recovery at 2022). Basemap: Aerial ortho-rectified aerial photography courtesy of the Channel Coastal Observatory (www.channelcoast.org). See appendix 3 for all the reaches



Figure 7: Coalescence and expansion of saltmarsh in Reach W4, as an example. Basemap: Aerial ortho-rectified aerial photography courtesy of the Channel Coastal Observatory (www.channelcoast.org). See appendix 3 for all the reaches

3.1.2. Condition assessment of reaches E2, W3, W4 and W6

This section reports changes observed during the W-walked transect and walkover surveys done in July 2020, September 2021 and June 2022.Description of the sites' condition in July 2020, September 2021 and June 2022 can be found in Appendix 4.

Reaches E2, W3, W4 and parts of W6 remain in a poor condition in most areas. There is historical evidence of poor condition for the last 10 years before the SATW project, so this condition is unlikely to be related to the engineering works. This poor condition is indicated by the lack of connectivity of the vegetation (patchiness), high proportion of bare ground in the vegetation patches, and higher proportion of *Spartina anglica* (particularly in W3 and W4) compared with established marsh in the better condition reaches W5 and W7.

While some good condition marsh dominated by *Atriplex portulacoides* is present at the northern extent of E2, most of the site is in a poor condition which has remained the case between the 2020, 2021 and 2022 surveys. This is due to the large amount of bare ground and lack of accommodation space adjacent to the tidal walls. It is possible this reach may disappear due to sea level rise as a result of this lack of accommodation space.

The 2021 and 2022 surveys have demonstrated W3 remains in a poor condition as was observed in the 2020 survey, with little change across the reach. Observed degradation in the reach is most likely caused by pollution, house boats and trampling and is unlikely to be associated with the works from the SATW project. There has been some erosion at the riverside edge of the zone. As this erosion is limited at this point it is unlikely to have a significant impact on the condition of the zone.

W4 has remained in a better condition than W3 when looking at all three surveys, mostly due to the fair condition marsh northwest of the footbridge. However, the section of W4 adjacent to W3 is in a poorer condition than the rest of the site due to patchiness of the vegetation, amount of bare substrate and percentage cover of *Spartina anglica,* which is likely due to physical disturbance from boat activities and trampling, as several were moored in this area. Northwest of the footbridge, the marsh has remained dominated by *Atriplex portulacoides* and is in a good condition as is the case in W5 (not included in the walkover surveys), with little bare ground. No change was observed in this reach from the previous surveys.

Reach W6 can be considered as two sections divided by the A259. The area south of the A259 adjacent to W5 in the RSPB marsh has remained in a good condition, with little bare ground. However, the width of the *Atriplex portulacoides* band has decreased since the 2020 survey by 7 m to 11 m, with further evidence of erosion at the cliff edge. Similar cliff development was also observed in W3. However, it is unlikely this is caused by the SATW works and is most likely the result of natural erosional and depositional processes.

The marshes in W6 north of the A259 has remained in a very poor condition. The area adjacent to the Adur Outdoor Activity Centre is the most severely degraded, with evidence of extensive

trampling, boat activity and vehicles (tyre tracks were observed). The area adjacent to the children's play park is narrow due to the high elevation gradient and in a generally poor condition, with damage to the sea wall evident where geotextile has become exposed around (50° 49' 59" N, 0° 17' 1"W), which is shown in Figure 8. This exposed geotextile indicates there is elevated erosion, with loss of sediment, most likely due to the position of the area on the outside of a meander in the river. This needs to be monitored and if conditions persist, methods such as fences/sediment trapping method can be explored (e.g. brushwood groyne) or intertidal recharge, if it possible to source sediments from nearby maintenance dredging operation or a more engineered approach may be necessary (Pontee et al, 2021). Where vegetation does occur, it is more mature than observed in the 2020 survey, suggesting recently colonised areas have stabilised. Otherwise, changes in condition are minimal. This section may have been impacted by the SATW works.



Figure 8: Exposed geotextile in reach W6. Taken on 20/09/2022 from (50° 49' 59" N, 0° 17' 1" W) looking south-east

3.2. Reach W7

3.2.1. Extent of saltmarsh in reaches W7

Changes in the established habitat extent in Reach W7 were assessed between 2016 and 2024 using manual digitisation of aerial photography (see section 2.3 for method details). The area of established saltmarsh included both lower and transitional mid to upper shore communities with a developed network of channels and mud flats. The total area of the vegetated areas was equivalent to **3.99 ha** in 2016 and comprised of 1.63 ha of lower/pioneer marsh and 2.26 ha of upper marsh (Figure 9).



Figure 9: Saltmarsh habitat in Reach W7 prior to the delivery of the SATW project in 2016. Basemap: Aerial imagery is courtesy of the Channel Coastal Observatory (www.channelcoast.org) taken in 2016

The set back of the tidal wall led to the development of a new area of saltmarsh and mudflats, namely "**new saltmarsh" of a total area of 1.29ha (**see Figure 10: 0.191 + 0.334 + 0.469 + 0.296 = 1.29 ha)**.** The area of established saltmarsh suffered a loss of 0.084 ha by 2024 due to erosion at the NMF Archimedes screw this was greater than the ceded 0.077 ha transfer site. However, when accounting for the land subsequently transferred to NMF after agreement of the planning permission reference number AWFM/0790/18 (Non-Material Amendment to AWDM/1614/15 for minor alterations to the design and construction of the Environment Agency tidal defences along part of eastern boundary of Brighton City (Shoreham) Airport (Reach W7).) this added to 0.084 ha (0.031 + 0.053 = 0.084 ha, see Figure 10). Following manual digitisation at 1:200 scale, the total area of saltmarsh created as compensatory habitat in reach W7meets the residual 1.243 ha (1.32 ha – 0.077 ha). This is calculated as follows:

1.29 (intertidal habitat created by EA SATW) + 0.084 (NMF habitat compensation) = 1.327 ha

Despite this loss, the total area of compensated habitat created as part of the SATW and NMF habitat compensation in reach W7 meets the 1.32 ha set by the Conditions of Planning of the project.

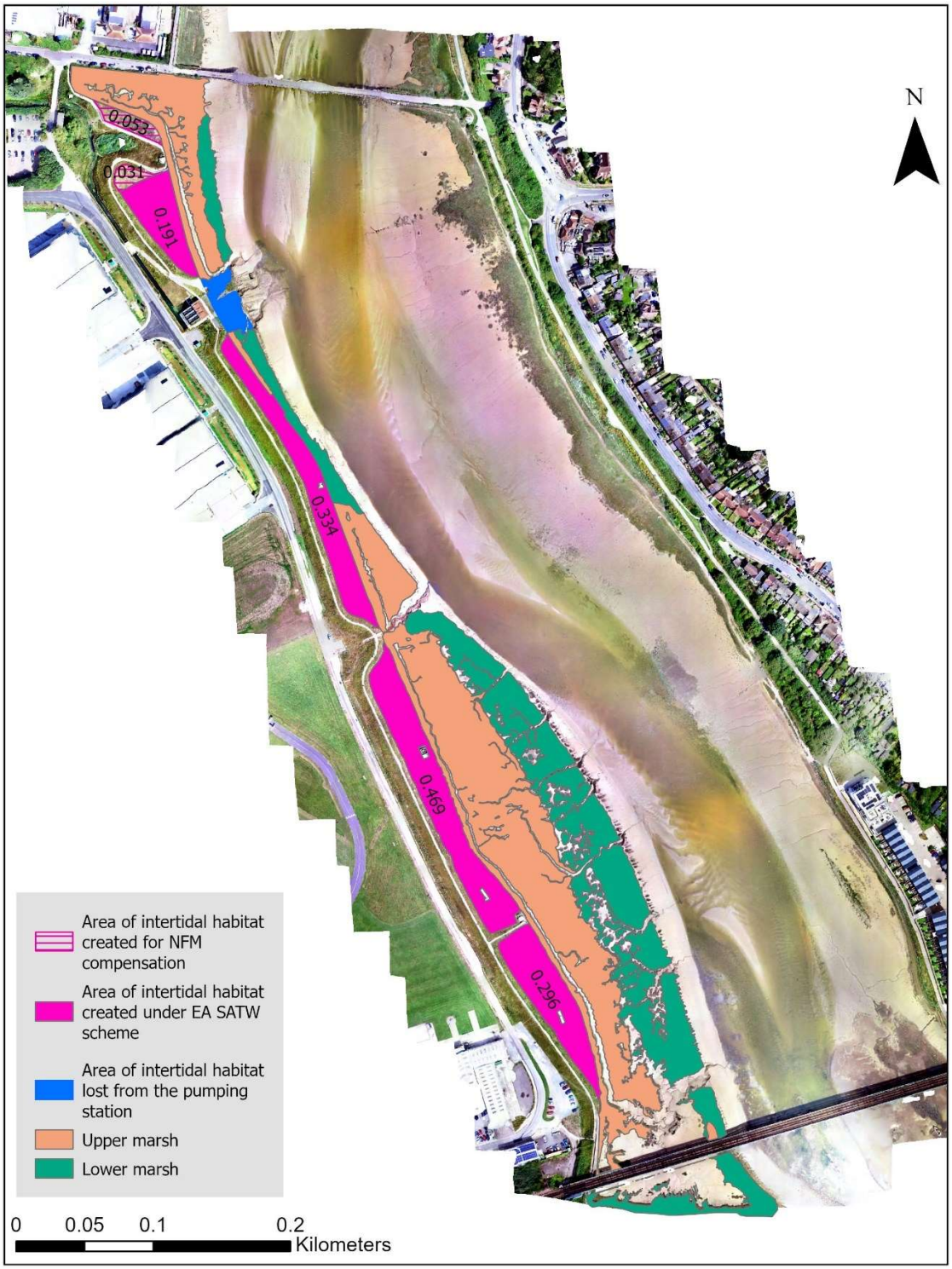


Figure 10: Intertidal habitats within reach W7 in 2024. Basemap: Aerial images captured by drone by the University of Brighton in summer 2024 and georeferenced.

3.3. Vegetation communities, structure and composition

3.3.1. Baseline assessment Reach W7

Mott MacDonald (2015) carried out a survey of the plant community within Reach W7, adjacent to Shoreham Airport, before the habitat restoration on behalf of the Environment Agency. They found W7 Reach was a mosaic of saltmarsh, scrub, reedbeds and ungrazed grasslands. The saltmarsh area comprised of pioneer marsh communities consisting of open areas with extensive mudflat channels and cord grass *Spartina* spp., glasswort *Salicornia europaea*, and Sea Aster *Tripolium pannonicum* (formerly *Aster tripolium*), merging into lower marsh communities of the salt-marsh grass *Puccinellia maritima*. Sea purslane *Atriplex portulacoides* (formerly *Halimione portulacoides*) was the most abundant species over the middle of the marsh, while the upper saltmarsh areas was dominated by Orache *Atriplex* spp., with a vegetative cliff along its low water edge, grading into several grazing marsh communities dominated by Couch grasses *Elymus* (formerly *Elytrigia*) spp. They found these communities formed a self- sustaining ecosystem that were covered daily by all high tides except for the lowest neap tides, when only part of the lower community was submerged.

The following NVC saltmarsh communities and sub-communities were identified within W7:

The saltmarsh communities identified included

- **SM12a *Asteretum tripolii* salt marsh coastal community**, present in the outermost area of the salt marsh habitat as a long strip of patchy open vegetation from the footbridge all the way down to the railway bridge. This is characteristic of salt marsh community of lower zonation.
- **SM14a *Atriplex portulacoides* salt-marsh community**, is the most species poor SM14 sub-community, dominated by sea purslane throughout and the vegetation stand is homogenous. In half of the quadrats sea purslane was present at 100%.
- **SM24 *Elytrigia atherica* salt-marsh community**, a very species poor community dominated throughout by Sea couch with infrequent False Oat grass, and mugwort.

Other communities identified within Reach W7 included:

- **MG1 *Arrhenatherum elatius* grassland community,**
- **MG1a *Arrhenatherum elatius* grassland, *Festuca-rubra* sub community**
- **MG7e *Lolium perenne* leys community- *Lolio plantaginetum* sub-community**
- **W24 *Rubus fruticosus- Holcus lanatus* underscrub**
- **W24b *Rubus fruticosus- Holcus lanatus* underscrub – *Heracleum sphondylium* sub community**
- **S4a *Phragmites australis* swamp and reed-bed community- *Phragmites australis* sub community**

3.3.2. Vegetation assessment in new marsh Reach W7

The surveys evaluated the ecological development of the new saltmarsh in W7 between 2019 and 2024.

By 2019, surveys in the new saltmarsh area showed that the habitat was open with high bare ground cover (mean 72% ± 17) interspersed with characteristic halophyte species of saltmarsh communities. The sward comprised of Annual Sea-blite (*Suaeda maritima)*, which was constant and abundant cover, and accompanied by Sea Aster (*Tripolium pannonicum*) and Glasswort spp (*Salicornia europaea*) which were also constant and occurred in lower abundance (Table 2 **Error! Reference source not found.**; Appendix 5). All species recorded were saltmarsh species and found locally, suggesting local colonisation sources. A total of 9 species were recorded, and most were indicative of pioneer saltmarsh communities (Appendix 1).

Output from the NVC classification (MAVIS) suggests that the vegetation type of the new saltmarsh area in 2019 resembled the **SM10 Transitional low-marsh vegetation with *Puccinellia maritima, annual Salicornia* species and *Suaeda maritima.*** This community of low marsh type is species-poor and typically always dominated by complementary proportion of *Salicornia spp, Suaeda maritima* and *Puccinellia maritima* (Rodwell, 2000). This community typically occurs in slight depressions and will be replaced by other communities as accretion progresses. The vegetation community present on site had low mean abundance of *Puccinellia maritima*, however this species was constant and present throughout the quadrats.

By 2020, the new salt marsh developed further, with a decrease in bare substrate notable (mean 57%) and an increase in vegetated cover, suggesting an increase of cover by colonizing species. Glasswort, Sea Aster, Annual sea-blite, Common salt marsh grass and Sea purslane were constant and becoming more abundant. Pioneer species such as glasswort and annual sea blite were still dominating the sward with mean abundance cover of 14%.

Further annual surveys between 2021 and 2024, saw the continuous decrease of bare ground cover with the lowest mean of 11% in 2024, an increase in species number with 14 species recorded. The most notable changes in species composition was the recorded presence of *Elymus athericus,* present in 50% of the quadrats and increasing in abundance becoming locally abundant in T1Q1 and T6Q16 in 2024 (Tables 3 and 4). *E. athericus* represents “true” high marsh species (Rodwell et al, 2000), which is a community that is not seen elsewhere in the Adur estuary. This is likely due to the higher elevation of the restored site when compared with established marsh in the estuary As a result of this greater elevation, inundation period and frequency are lower, thus facilitating the colonization of *E. athericus* as this species has a lower autoecological tolerance of flood stress than typical mid and lower marsh species.

The decrease in abundance of pioneer species such as *Salicornia europaea and Suaeda maritima* between 2019 and 2024 was accompanied by a substantial increase of *Puccinellia maritima* and *Atriplex portulacoides* suggesting successional development from pioneer marsh toward a low/mid marsh communities.

In July 2024, *P.maritima* represented the greatest cover in the new marsh followed by *Atriplex portulacoides*, another constant and locally abundant species. Notable new species were recorded in summer 2024, including Greater sea spurrey (*Spergularia media),* Hard grass (*Parapholis strigos*a), Curved hard grass (*Parapholis incurva*), and annual beard-grass (*Polypogon monspeliensis)* further supporting natural successional trajectory of the new marsh. These changes mark the transition from an annual pioneer species assemblages to a perennial low to mid marsh species assemblage however establishment of later successional species appears to be patchy suggesting maybe different elevational niches.

While later successional development might favour *Atriplex portulacoides* dominance, several studies have found that species can occupy a higher elevational niche on restored salt marshes, which has been attributed to poor drainage (Garbutt et all, 20026, Garbutt and Wolters, 2008, Mossman et al, 2012). If this occurs and persists, then the site may retain species characteristic of low marsh. Continued monitoring may be required and creation of creeks to augment drainage could be considered (see Saltmarsh and Mudflat Compensatory Habitat Plan, Mott MacDonald, September 2016, see Table 3.1).

Table 2:Mean abundance of species richness, bare ground, litter and individual species identified during annual surveys in new saltmarsh in Reach W7 between 2019-2024

New	2019	2020	2021	2022	2023	2024
Species richness	5.1	5.4	5.4	5.6	5	5.9
Suaeda_maritima	11.5	14.2	2.6	4	0.9	1.4
Salicornia_europaea	5.1	14.6	12.7	2.5	3.8	2.2
Tripolium_pannonicum	3.2	2.4	3.9	3.6	3.5	4.8
Puccinellia_maritima	1.3	5.1	32.1	30.1	35.2	34.2
Spartina_anglica	0	0	0	0	0	0
Elymus_athericus	1.7	0	10.2	4	9.7	20
Atriplex_portulacoides	2.8	4.2	8.1	20.9	13.1	18.9
Spergularia_marina	0.3	0.7	0.8	1.4	1.3	1.9
Atriplex_prostrata	0.5	0.1	0.1	0	0	0.2
Artemisia_maritima	0.3	0	0	0.9	0.5	0.3
Phragmites_australis	0	0.2	0	0.2	0.2	0.4
Elymus_repens	0	0.4	0	0	0	0
Plantago_maritima	0	0	0	0.1	0	0
Parapholis_strigosa	0	0	0	0	0	1.1
Parapholis_incurva	0	0	0	0	0	0.2
Polypogon_monspeliensis	0	0	0	0	0	0.4
Spergularia_media	0	0	0	0	0	1.5
Moss	0	0	0.1	0	0	0
Algae	0	0.6	1.2	0	0	0.4
Dead_algae	0	0	0	0	0	0
Litter	1.5	1	1.2	1.3	0.6	1.2
Bare_ground	71.9	56.5	27.1	30.7	31.6	11.2

Table 3: NVC species summary table in new saltmarsh in 2019 and 2024 surveys with abundance for each species recorded as Domin scale (1-10) and frequency class (I-V). ↘: indicates a decrease in abundance between 2019 and 2024, ↗: indicates an increase in abundance between 2019 and 2024, = indicates no change.

Common English name	Scientific name	New 2019	New 2024	
Annual sea blite	*Suaeda maritima*	V (1-5)	IV (1-3)	æ
Sea purslane	*Atriplex portulacoides*	V (1-4)	V (1-9)	ä
Sea aster	*Tripolium pannonicum*	V (1-4)	IV (2-5)	æ
Glasswort	*Salicornia europaea*	V (1-5)	IV (1-4)	æ
Sea couch	*Elymus athericus*	III (1-4)	III (1-8)	ä
Common salt marsh	*Puccinellia maritima*	II (1-4)	V (4-9)	ä
Lesser Sea spurrey	*Spergularia marina*	I (1-2)	I (1-5)	ä
Sea wormwood	*Artemisia maritima*	I (1-2)	I (1-3)	=
Spear-leaved orache	*Atriplex prostrata*	I (1-4)	I (1-2)	=
Common Reed	*Phragmites australis*		I (1- 4)	ä
Slender barb grass	*Parapholis strigosa*		IV (1-4)	ä
Curved hard grass	*Parapholis incurva*		I (1-2)	ä
	Litter	V (1-2)	V (1-3)	=
	Bare ground	V (7-10)	V (1-8)	æ

3.3.3. Vegetation assessment in Established marsh in Reach W7

The upper and lower saltmarsh areas in W7 can be considered in a good condition, with little bare ground and expected cover of species typical for established saltmarsh in the Adur estuary. NVC communities represented include **SM12a *Asteretum tripolii* salt marsh coastal community**, and **SM14a *Atriplex portulacoides* salt-marsh community**.

Lower marsh

Following the tidal wall works, an increase in bare ground cover was noticeable in the lower marsh from 15% in 2019 to 22% in 2020, however this was not sustained, and a decrease has been noted since 2020 suggesting recovery after cessation of disturbance activity (Table 4).

Notable changes in the vegetation composition over the survey period were the substantial increase in abundance of *Puccinellia maritima*, this constant species became dominant in 2024, occupying between 40% to 90% of the quadrat area. *Tripolium pannonicum* abundance declined in 2020 but since has shown a recovery and occurs constantly across the lower marsh. However, *Atriplex portulacoides* relative abundance and frequency of occurrence has been decreasing. This could be due to the competitive nature of *P.maritima* and it is well established (Table 4 and Table 6).

The community resembles the **SM12a *Asteretum tripolii* salt marsh coastal community** due to the constancy and abundance

Table 4: Mean abundance of species richness, bare ground, litter and individual species identified during annual surveys in established lower saltmarsh in Reach W7 between 2019-2024.

Established lower	2019	2020	2021	2022	2023	2024
Species richness	4.4	4.6	4.1	5.3	4.8	4.4
Suaeda_maritima	0.2	3.6	0.6	2.6	0.6	0.7
Salicornia_europaea	22.7	9.8	13.3	17.5	11.1	5.6
Tripolium_pannonicum	11.4	5.1	4.4	7.4	9.1	10.3
Puccinellia_maritima	23.2	52	64	54.4	45.3	66.5
Spartina_anglica	5.4	0.8	3.6	2.4	3.9	2.8
Elymus_athericus	0	0	0	0	0	0
Atriplex_portulacoides	19.1	5.7	9.1	6.9	12.9	5.1
Spergularia_marina	0	0.1	0	0.4	0	0
Algae	0	0.6	2.1	0.5	2.8	2.8
Litter	3.1	0.7	0.9	1.4	0.1	0.9
Bare_ground	15	21.6	1.4	7.9	14.2	5.9

Upper marsh

The upper marsh plant community remained relatively unchanged over the monitoring period (Tables 5 and 6). Dominated by *Atriplex portulacoides,* it is a species poor, uniform stand of Sea purslane with the occasional *Triplolium pannonicum*, *Salicornia spp* and *Suaeda maritima* in those lower elevational depressions.

In July 2024, algal mat appeared to cover the plants, reducing the abundance of *A.portulacoides.* It is unclear whether the algae developed naturally as a result of warm weather or if this is linked to increase nutrient loading of site which could result in algal wrack accumulation on salt marsh (Wasson et al, 2017).

This part of the salt marsh resembles the **SM14a *Atriplex portulacoides* salt-marsh community,** which is typically found in the upper zonation of salt marsh (Rodwell et al, 2000).

Spartina anglica is a species that is considered undesirable in intertidal habitats due to its competitive and expanding nature at the expense of mudflats, has remained in low abundance and infrequent throughout the monitoring period in both lower shore and upper shore marsh.

Table 5: Mean abundance of species richness, bare ground, litter and individual species identified during annual surveys in established upper saltmarsh in Reach W7 between 2019-2024

Established upper	2019	2020	2021	2022	2023	2024
Species richness	1.3	1.5	1.4	1.8	1.5	1.8
Suaeda_maritima	0	0	0.1	0.4	0.2	0.1
Salicornia_europaea	0	0.2	0	0.5	0	0.1
Tripolium_pannonicum	2.6	2	0.4	0.3	0.4	0.5
Puccinellia_maritima	0	0	0	0.6	0	0.3
Spartina_anglica	0	0	0	0	0	0.1
Atriplex_portulacoides	90.2	94.7	98.1	94.6	95.1	74
Algae	0	1.8	1.6	1.6	2.1	17.3
Dead_algae	0	0	0	0	0	6.3
Litter	1.6	0.2	0.3	0.7	0.6	1.3
Bare_ground	5.7	1.1	0.3	1.1	1.6	1

Table 6:NVC species summary table in lower and upper saltmarsh in 2019 and 2024 surveys with abundance for each species recorded as Domin scale (1-10) and frequency class (I-V). ↘: indicates a decrease in abundance between 2019 and 2024, ↗: indicates an increase in abundance between 2019 and 2024, = indicates no change.

Common English name	Scientific name	Lower 2019	Lower 2024		Upper 2019	Upper 2024		
Glasswort	*Salicornia europaea*	V (4-7)	V (1-5)	æ		I (1-2)	ä	
	Spartina anglica		II (1-5)	ä		I (1-2)		ä
Sea aster	*Tripolium pannonicum*	V (4-5)	V (3-5)	=	II (1-4)	II (1-2)		=
Annual sea blite	*Suaeda maritima*	I (1-2)	III (1-3)	ä		I (1-2)		ä
Common salt marsh grass	*Puccinellia maritima*	IV (1-8)	V (7-9)	ä		I (1-2)		ä
Sea purslane	*Atriplex portulacoides*	IV (1-8)	III (1-7)	æ	IV (9-10)	V (5-10)		ä
	Algae		V (1-4)	ä		V (2-7)		ä
	Litter	V (1-4)	V (1-2)	=	IV (1-3)	V (1-3)		=
	Bare ground	V (4-5)	V (1-5)	æ	IV (1-4)	IV (1-3)		æ

3.4. Other negative indicators

3.4.1. Trampling

It was noted in 2020 that a well-used footpath as wide as 4m in some places developed through Reach W7 area where the old tidal wall foundations were located. This area was heavily trafficked by the public in 2020 due to displacement from the crest path while the NMF pumping station work was undertaken and has remained used ever since. As a result, a clear walkway at the border of the established upper marsh and the new marsh is now visible, creating a compact area with little recovery of the marsh, fragmenting the whole marsh and is as wide as 4m in some places and

>500m in length. Little establishment of saltmarsh species has been observed during the surveys, and it would be recommended to monitor this to avoid further widening of the path.

Trampling and other activities have also been noted across the site, this could initiate local erosion if it increases, potentially affecting the site if not managed.

4. Conclusions

The key objectives of the SATW scheme for the EA included the following:

- **Objective 1**: Demonstrate recovery and where possible improvement in Reaches E3, W3, W4 and W6 following SATW works
- **Objective 2:** In Reach W7, create a new area of intertidal habitat by moving tidal wall landwards. The new area would equate to 1.32 hectares
- **Objective 3:** Monitor the establishment of self-sustaining saltmarsh and mudflats communities (reach W7)

Objective 1:

Table 7 summarises the condition and development recorded across reaches E2, W3, W4 and W6, noting the poor condition but **improving** status for most of the reaches. The constrained nature of the site limits further expansion of the saltmarsh area however extent of patches was measured suggesting **recovery following the SATW disturbance works** to demonstrate compliance with planning condition 10. Reach W4 and W6 are in fair to good condition but monitoring of erosion along the sea wall should be recommended.

Table 7:Summary of the condition changes across reaches E2, W3, W4 and W6 along with recommendations for remediation actions

Reach	Notes	Recommendations
E2	Condition has remained poor, although it is improving. Vegetation cover has remained similar in composition over the study period. Extent have increased, demonstrating conditions in the reach have improved However, further increases are prevented as the reach is constrained by the sea wall. The poor condition of the reach is due to its constrained nature.	No remediation actions recommended As the poor condition in the reach is due to its constrained nature, there is no practical remediation that can improve the condition.
W3	Condition has remained poor, although it is improving. There have been minimal changes in species cover of the study period Extents have increased substantially since 2016, despite a loss of marsh during the SATW works. This has been due to a patch expansion and coalescence. The patchiness of the vegetation is indicative of the poor condition of the reach. This is thought to be a result of physical disturbance from boat usage in the area, and this is unrelated to the SATW works, However the extent change analysis reveals this is improving,	No remediation actions recommended The current poor condition is unrelated to the SATW works as areas lost during construction have since recovered and thus no remediation from the SATW project is required. Conditions appear to be improving within the reach with patch expansion and coalescence and thus it is suggested that it would be best to leave conditions to improve naturally
W4	Conditions have remained fair There have been minimal changes in species cover throughout the study period. Extents have increased due to patch expansion and coalescence. The area east of the footbridge is in a poorer condition with sparser vegetation cover and disconnected patches, likely due to the same reasons as W3 which is adjacent.	No remediation action recommended The fair condition of the reach is not a cause for concern as the poor conditions areas are unrelated to the SATW works Also, increasing extents demonstrate condition is improving naturally
W6	Condition has remained fair-good. The reach may be considered in two sub-sections – north/south of the A259.	Remediation of exposed geotextile

	North of A259, condition has remained poor in the areas adjacent to the Adur Activity Centre from physical activity in the area. However, despite disturbance, extents have increased here. There is also an area of geotextile along the sea wall which demonstrate erosion is occurring here which is a cause for concern. South of the A259, conditions has remained good due to very little disturbance. around the Adur Recreation Centre and natural fluvial erosion and not SATW works.	

Objective 2: Create a new area of 1.32 hectares of intertidal habitats as stipulated in planning condition 7 of the consented SATW scheme

In fulfillment of Condition of planning for SATW, the Environment Agency was required to deliver 1.32 ha of functional new intertidal habitat. The set back of the tidal wall in reach W7, West-adjacent to Brighton City Airport. **resulted in the creation of 1.29 ha of saltmarsh in Reach W7 and an additional 0.084 through the NMF compensation scheme.**

- **Objective 3:** Monitor the establishment of self-sustaining saltmarsh and mudflats communities (reach W7)

Monitoring of Reach W7 new saltmarsh and mudflats clearly indicated that new colonizing species in the newly created saltmarsh are halophytes and characteristic of saltmarsh communities.

The abundance and frequent occurrence of pioneer species as soon as 2019 following the tidal work suggest colonization from local sources and this has further developed into a transitional pioneer to low salt marsh. The vegetation remains open in some areas, where depressions are visible but other areas show an abundance of Common salt marsh grass and Sea purslane.

The vegetation communities within Reach 7 resemble the following saltmarsh NVC types: **SM12a *Asteretum tripolii* salt marsh coastal community, SM14a *Atriplex portulacoides* salt-marsh community** and **SM10 Transitional low-marsh vegetation with *Puccinellia maritima, annual Salicornia* species and *Suaeda maritima,* all** of which are characteristic of saltmarsh communities found along the coastline of southeast England.

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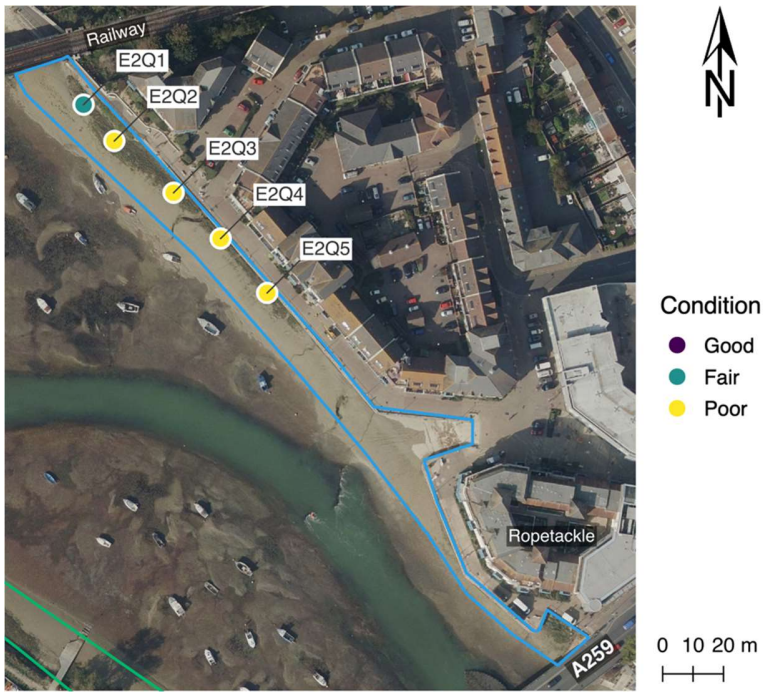
Appendices

Appendix 1: Typical species for saltmarsh zones

Pioneer zone	Low-mid marsh	Mid-upper marsh
Suaeda maritima *Salicornia spp* *Tripolium pannonicum* *Puccinellia maritima*	*Puccinellia maritima* *Triglochin maritima* *Plantago maritima* *Atriplex portulacoides* *Tripolium pannonicum* *Spergularia marina* *Suaeda maritima* *Salicornia spp*	*Festuca rubra* *Juncus gerardii* *Armeria maritima* *Agrostis stolonifera* *Limonium vulgare* *Glaux maritima* *Artemisia maritimum* *Plantago maritima* *Tripolium pannonicum* *Juncus maritimus* *Triglochin maritima* *Blysmus rufus* *Eleocharis uniglumis* *Artemisia maritima* *Leontodon autumnalis* *Carex flacca* *Carex extensa* *Turf fucoids*

(CSM guidance, 2004)

Appendix 2: Location of quadrats used for condition assessment in reaches E2, W3, W4 and W6



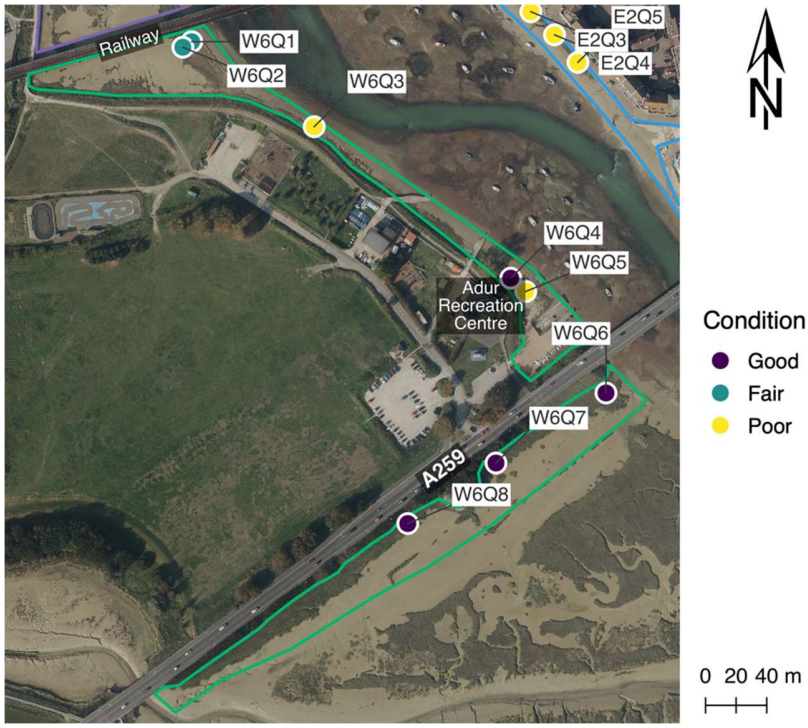
Location and condition of the quadrat in Reach E2. Aerial imagery is courtesy of the Channel Coastal Observatory (www.channelcoast.org) and was taken on 20/09/2020.



Location and condition of the quadrats in Reach W3. Aerial imagery is courtesy of the Channel Coastal Observatory (www.channelcoast.org) and was taken on 20/09/2020.



Location and condition of the quadrats in Reach W4. Aerial imagery is courtesy of the Channel Coastal Observatory (www.channelcoast.org) and was taken on 20/09/2020.



Location and condition of the quadrats for reach W6. Aerial imagery is courtesy of the Channel Coastal Observatory (www.channelcoast.org) and was taken on 20/09/2020.

Appendix 3: Extent of intertidal habitats in Reaches E2, W3, W4 and W6 between 2016, 2020 and 2022.

Images are Ortho-rectified aerial photography from the Channel Coastal Observatory.

Reach E2



2016_ 07_23. Scale 1:1000



2020_ 09_15. Scale 1:1000



2022_ 08_14. Scale 1:1000

Reach W3



2016_ 07_23. Scale 1:1000



2020_ 09_15. Scale 1:1000



2022_ 08_14. Scale 1:1000

Reach W4



2016 07 23. Scale 1:1000



2020_ 09_15. Scale 1:1000



2022_ 08_14. Scale 1:1000

Reach W6


2016_ 07_23. Scale 1:12500
W6
W6


2020_ 09_15. Scale 1:2500
W6
W6


2022_ 08_14. Scale 1:2500
W6
W6

Appendix 4: Vegetation description for reaches E2, W3, W4 and W6

Surveys in June-July 2020

Reach E2

At reach E2 the salt marsh is very tightly constrained against the piling adjacent to the walkway. In the walkover survey conducted in 2020, the site was surveyed at five points although a W shaped walk was impossible due to the narrow width of the saltmarsh. At the north end of the salt marsh at E2, there was ~100% cover of *Halimione portulacoides* in the vegetated section, which was 2m wide and showed evidence of recent erosion at the margin.

Moving 5 metres downriver from the northern end of the saltmarsh in reach E2, the intertidal vegetation is narrowed by established terrestrial vegetation (bushes) that have been present for >5 years, at the higher elevation of the site adjacent to the defence structure. The width of the saltmarsh in this section is 1m and is dominated by *Halimione portulacoides* (90% cover) with some bare ground. As you continue downriver in this reach, the *Halimione portulacoides* is no longer present in the narrow strip adjacent to the bushes due to a decrease in elevation. Here, the saltmarsh widens to 2m and is covered with ~50% *Salicornia europaea* and ~50% bare ground.

Further downstream E2 past the wooden boardwalk (50°50'01.64" N, 0°16'52.49" W), the *Salicornia europaea* dominated salt marsh gives way to a 1m strip of salt marsh dominated by *Halimione portulacoides*, which extends for 10m. At the lower reaches (low marsh closer to the river) of this section, extending for 3m is a mixed lower marsh patch with 85% vegetation cover and 15 % bare ground. The vegetation is dominated by *Salicornia europaea* (80%), with scattered *Puccinellia maritima* and *Aster tripolium*.

From the road drainage outflow (50°50'00.86" N, 0°16'51.51" W) there are small isolated patches of saltmarsh adjacent to the defence structure with occasional *Halimione portulacoides*, *Salicornia europaea* (up to 60% cover), and very sparse *Aster tripolium* and *Spartina* sp. (~1%).

Reach W3

At reach W3 the saltmarsh was mixed with patches where alternately *Spartina* sp., *Puccinellia maritima*, and *Salicornia europaea* are dominating. These are interspersed with large bare substrate patches in the areas around the boats that are moored in the saltmarsh (house boats and swinging moorings) covering about 30% of the area of the reach.

There is a narrow band at the seaward end of this reach in the lower elevation where *Salicornia europaea* is dominant, either as a pioneer (recently colonised) or as an established lower marsh species (varies over the site) (50°49'50.22" N, 0°16'04.55" W).

In the higher elevation areas of W3 at the seaward end of the reach (50°49'50.37" N, 0°16'04.58" W), *Puccinellia maritima* is dominant with some patches of *Spartina* sp. dominating (typically no larger than 3m diameter). This upper marsh patch at the seaward end is in a poor condition as a result of the impacts of the boat mooring and associated infrastructure.

In the centre of reach W3 (50°49'49.37" N, 0°16'12.89" W) the upper salt marsh is more prevalent with less bare substrate, and there is *Halimione portulacoides* dominant (95% cover) in the upper marsh with occasional *Aster tripolium*. The lower marsh here comprises mixed patches of *Spartina* sp. dominant (60% cover 40% bare), *Puccinellia maritima* dominant (80% cover, 20% bare), and *Salicornia europaea* dominant (70% cover, 30% bare), in roughly equal proportions dependent on location.

Adjacent to the path at the upstream end of reach W3 (50°49'47.89" N, 0°16'21.83" W) the reach is dominated by bare substrate in the higher elevation areas. The lower elevation areas of marsh are dominated by *Salicornia europaea*, which grades into mixed *Puccinellia maritima* and *Salicornia europaea* marsh in equal proportions. At the edge of the salt marsh in this upstream section of the reach adjacent to the river channel (50°49'49.09" N, 0°16'23.18" W) there is evidence of recent erosion.

Reach W4

Adjacent to W3 in the W4 reach (upriver of the path, 50°49'49.08" N, 0°16'23.10" W), *Salicornia europaea* dominates in a thin 2m wide strip by the river channel edge. Directly inland from this is a *Puccinellia maritima* dominated zone, which grades into a *Spartina* sp. dominated zone, then in a mixed *Halimione portulacoides* zone mixed with *Puccinellia maritima* at the sea wall defence structure in the higher elevation area. This section of the W4 reach is in a better condition than any section of the W3 reach, with less patchy vegetation and less bare ground.

Moving further upstream of the footbridge and adjacent to it (50°49'48.12" N, 0°16'24.85" W), the W4 saltmarsh condition substantially improves and this is representative of the whole of this section of the reach. However, there is no low marsh at river edge due to erosion as evidenced by a cliff. The vegetation is directly into *Halimione portulacoides* dominant marsh (~95% cover). Moving inland the marsh becomes more mixed and is covered by *Halimione portulacoides* and *Salicornia europaea* in roughly equal proportions, with little bare substrate. Closer to the flood defence structure inland the marsh moves into an ecotone of mixed *Halimione portulacoides*, *Salicornia europaea* and *Spartina* sp. and eventually into *Spartina* sp. dominated salt marsh. The channel near the flood defence structure 15m upstream of the footbridge is adjacent to a patch of bare substrate which grades into a *Salicornia europaea* dominated marsh zone and then a *Halimione portulacoides* dominant zone closer to the river channel.

There is limited variation in the upstream half of the W4 reach and the site is in a similar condition to reach W5 (i.e very limited impact, good condition of the salt marsh and considered a baseline

for the unimpacted saltmarsh in the Adur) and is dominated by *Halimione portulacoides* (95% cover). However, a note for this upstream half of the reach is that there is some limited impact from the tidal wall construction e.g. a narrow 2m band that is unvegetated directly adjacent to the wall structure (50°49'46.97" N, 0°16'24.75" W).

Reach W6

W6 is split into two sections separated by the A259. On the south side of the A259 there is a narrow strip of saltmarsh that runs directly adjacent to the road (Figure 2). This runs from the western bridge (leading to the creek by New Salts Farm,) to Norfolk Bridge. This is comprised of a 15m to 25m wide stretch of *Halimione portulacoides* (95% cover) to the RSPB viewpoint (50°49'54.00" N, 0°16'44.00" W) mostly running from the upper marsh adjacent to the road to the creek edge (50°49'48.00" N, 0°17'1.00" W). At the creek edge there is evidence of erosion (small cliff). In patches there occurs some lower marsh mixed with young *Salicornia europaea* and *Suaeda maritima* (<10%) and *Aster triploium* and older *Salicornia europaea* (40/20% respectively), with the remainder as bare ground.

At the RSPB viewpoint the salt marsh narrows to 3m with a small spit. The vegetation here has an 80% vegetation cover roughly equally covered by *Halimione portulacoides* and *Salicornia europaea*.

From the RSPB viewpoint there are scattered patches of vegetation between 2-5m diameter in the mudflats covered with *Spartina* sp. (50% bare ground) at the edge and *Puccinellia maritima* (30% bare ground) in the centre at a higher elevation.

From the RSPB viewpoint moving towards the river adjacent to the road the *Halimione portulacoides* strip is 6m wide widening to 20m (at 50°49'53.00" N, 0°16'41.00" W) with a vegetation cover of approximately 95% in the upper marsh here. There is a narrow lower marsh band here adjacent to the creek from 3m wide and narrowing to nothing. This consists of *Puccinellia maritima* (60%) and *Aster tripolium* (20%).

At the river end of this stretch the plant community is very mixed with *Halimione portulacoides* dominated patches, *Triglochin maritimum* dominated patches (high upper marsh adjacent to road) and patches with 80% vegetation cover and *Aster tripolium*, *Salicornia europaea* and *Puccinellia maritima* in equal proportions.

In the section north of Norfolk Bridge adjacent to Adur Ooutdoor Activity Centre the salt marsh is highly degraded and in very poor condition due to the boat moorings. It is comprised of mixed patchy *Halimione portulacoides*, *Puccinellia maritima* and new *Salicornia europaea* with 50% veg cover here.

North of the slipway near the play park (50°49'58.00" N, 0°16'50.00" W), there is a thin 3-5m strip of patchy saltmarsh in a poor condition. This consists of a narrow 30cm strip of *Halimione*

portulacoides, 2m strip of *Puccinellia maritima* and a 2m strip of *Salicornia europaea* at the widest point.

Adjacent to the railway bridge (50°50'0.00" N, 0°16'51.00" W), there is a 20m wide by 40m long strip of degraded and patchy *Puccinellia maritima* (50% veg cover, 50% bare) in the lower elevation zone and in the higher elevation zone this is dominated by *Halimione portulacoides* (70% veg cover, 30% bare).

September 2021 surveys

Reach E2

The location of the quadrats within reach E2 is shown in appendix 2.

The salt marsh in E2 was narrow and tightly constrained against the piling adjacent to the walkway. At the north end of the marshes at E2Q1 (50°50'2" N, 0°16'54 W), there was a small 3-4 m wide band dominated by *Atriplex portulacoides* (~90% cover) which had populated the wreckage of an old boat and was in a good condition.

Moving downriver to E2Q2, a banded patch of vegetation was found. At the landward side, this was dominated by *Atriplex portulacoides* with occasional *Tripolium pannonicum* which was 2-3 m wide and 43 m long and in a fair condition. This band was backed by terrestrial plants (bushes) at a higher elevation along the northern 18 m. At a lower elevation (50°50'1" N, 0°15'53" W), an established mix of low marsh species, including *Salicornia europaea*, *Puccinellia maritima* and *Tripolium pannonicum* were found. This unit was in relatively poor condition with sparse (~50%) cover. A narrow band of pioneer *Salicornia* could be found along the lowest elevation.

Moving further south to E2Q3, the bands of *Atriplex portulacoides* and low marsh were lost and gave way to a singular unit that was in a poor condition and is shown in Figure 6**Error! Reference source not found.**. This was dominated by *Salicornia europaea*, with occasional *Suaeda maritima*, *Atriplex portulacoides* and *Tripolium pannonicum*. This unit was 12 m long and 5 m wide and stretched south to the stormwater drain (50°50'1" N, 0°16'52" W). The same vegetation continued south of the stormwater drain for 30 m, at 3 m to 4 m wide as can be seen in Figure 11.

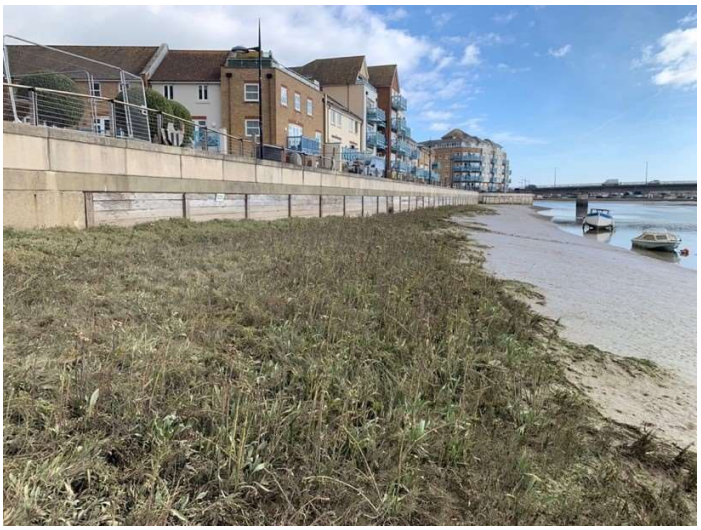


Figure 11: Narrow band of poor condition vegetation that stretches across most of the E2 zone. Taken from 50° 50' 2" N, 0° 16' 53" W looking south-east, 13/10/21

Further downstream at E2Q4 (50°59'0" N, 0°16'51" W), a small (5 m x 2 m) patch dominated by *Atriplex portulacoides* was found with a *Salicornia*-dominated low marsh community adjacent to the river edge. This continued southward into a narrow (1 m) band of pioneer *Salicornia europaea* marsh, which then widened to 3-5 m for 25 m with occasional *Tripolium pannonicum* in the southern limit of the marshes in E2 (50°49'59" N, 0°16'50" W).

Reach W3

The location of the quadrats within reach W3 is shown in appendix 2.

Starting at the seaward end of W3 at W3Q1, there was a banded patch of marsh between the boat jetty (50°49'51" N, 0°16'6" W) and the slipway (centroid 50°49'51" N, 0°16'5" W). This was backed by an 11 m wide band of mudflat against the tidal wall suggesting potential degradation. Moving from this patch towards the river, a 9 m wide band dominated by *Salicornia europaea* was found which was in a fair condition (~70% cover). Moving further towards the river, a mixed patch of *Salicornia europaea* and *Spartina anglica* was found with approximately equal abundance and a total vegetation cover of ~60%. Below this band was a patch dominated by *Salicornia europaea* (~50% cover), although mixed with *Atriplex portulacoides*, *Puccinellia maritima* and *Tripolium pannonicum* with a vegetation cover of ~70%. Moving from this patch towards the river edge, a 6 m band of *Salicornia europaea* and *Tripolium pannonicum* with sparse *Puccinellia maritima* was found.

Moving up-river from the boat jetty to W3Q2, a highly degraded patch with very low vegetation cover was found (<10 m^2). Between the two jetties, there was a 9 by 18 m patch dominated by *Atriplex portulacoides* with occasional *Salicornia europaea*. This patch was in a fair condition, although evidence of erosion could be found around it related to boat activity.

Between the jetty (50°49’50” N, 0°16’12” W) and the pontoon adjacent to Harbourside Coachworks (centroid 50°49’50” N, 0°16’13” W) at W3Q3, a banded patch of salt marsh was found. There was a large patch dissected by creeks that backed onto the tidal wall. This patch was dominated by *Salicornia europaea* with occasional *Atriplex portulacoides* and was in a fair condition. Below this patch, there was a narrow 15 m band of pioneer *Salicornia europaea* with very sparse (<5%) vegetation cover.

From Harbourside Coachworks (centroid 50°49’50” N, 0°16’13” W) to the houseboat at the inland edge of W3 (50°49’48” N, 0°16’21” W), a large, fragmented patch of degraded salt marsh was found between the boats and pontoons at W3Q4. This was dominated by *Spartina anglica* with occasional *Salicornia europaea* and *Tripolium pannonicum* and was in a very poor condition. This poor condition is almost certainly caused by moorings in the area causing physical disturbance, pollution could be an issue but this would require additional analysis.

Surrounding the houseboat around W3Q5 was a patch of unvegetated mudflat, likely degraded due to its proximity to the houseboat and trampling/movement of the boat on mooring. Moving towards the river, a banded patch of marsh (centroid 50°49’49” N, 0°16’21” W) was connected to the path that forms the boundary between reaches W3 and W4 (centroid 50° 49’ 49” N, 0° 16’ 22” W). At the inland edge, a 15 m band of degraded salt marsh was present. This contained a mix of *Salicornia europaea*, *Spartina anglica*, and *Tripolium pannonicum* in roughly equal quantities with a total vegetation cover of ~70%. Moving towards the river, this was followed by a more densely covered patch (~90%) which was dominated by *Puccinellia maritima*, with *Suaeda maritima*, *Salicornia* and *Tripolium pannonicum* and finally a narrow (6 m) band of pioneer *Salicornia* marsh along the river edge, where cover was patchy, and erosion was evident. Overall, this patch was 26 m wide (parallel with the river).

Reach W4

The location of the quadrats in W4 is shown in appendix 2.

Between the path that marks the boundary between reaches W3 and W4 (centroid 50° 49’ 49” N, 0° 16’ 22” W), and the footbridge across the Adur (50°49’48” N, 0°16’22” W), a banded patch of marsh was present. Against the sea wall at W4Q2, there was a narrow band (2-5 m) of *Atriplex portulacoides*, which was in poor condition, with patchy cover (40-70%). Several boats were moored in the marsh here, likely causing the poor condition. Adjacent and at a slightly lower elevation, there was a zone dominated by *Puccinellia maritima* and *Salicornia europaea*, with occasional *Spartina anglica* and *Tripolium pannonicum* (<5%). Moving towards the river, an area of patchy *Spartina* and mudflat could be found which was approximately 31 m long. This was followed by 18 m of patchy degraded marsh at W4Q1, with evidence of physical disturbance from moored boats and steppingstones nearby which likely caused this degradation. Vegetation cover contained *Puccinellia*, *Salicornia*, and *Tripolium* at equal proportions with occasional *Spartina* and bare substrate. Along the edge of the river, there was a 4-6 m band of pioneer *Salicornia*

vegetation with evidence of natural cyclical erosion at the edge. This patch was in a better condition than in W3 likely due to less boat activity.

Directly under the bridge was predominantly mudflat potentially due to a lack of recovery following bridge construction. At the river's edge, a thin band of *Suaeda maritima* was present.

West of the footbridge in quadrats W4Q3-5, the salt marsh was in very good condition, although there was evidence of recent erosion at the river edge cliff. No pioneer community was found at the river's edge, instead a 15 m band dominated by *Atriplex* was present. Moving further inland, this gave way to a 17 m band of mixed *Spartina*, *Salicornia* and *Tripolium* with a vegetation cover of 80%. This was followed by 7 m of mudflat which separated the riverside vegetation from a patch against the sea wall. Moving landward from the mudflat, this inland patch began with a narrow (3-5 m) band of *Salicornia*. This band was then followed by a higher elevation 21 m band of *Atriplex*-dominated marsh noted at W4Q4, with occasional patches of *Salicornia* and *Suaeda*. Trampling and associated damage to the vegetation was evident adjacent to the sea wall in this patch, this appears to be a desireline which could be addressed through signage.

Reach W6

The location of the quadrats in W6 is shown in appendix 2.

W6 is split into two sections by the A259. On the south side of the A259, there is a section running parallel with the road. This runs from the western bridge (leading to the creek by New Salts Farm), to Norfolk Bridge. This was comprised of a 4 m to 18 m wide stretch of *Atriplex portulacoides* (90% to 100% cover) recorded in W6Q8 and W6Q7 and runs from the western bridge to the RSPB viewpoint (50°49'54" N, 0°16'44" W) and is in a good condition. At the creek edge, there were patches of mixed low marsh *Tripolium pannonicum*, *Puccinellia maritima* and *Salicornia europaea* with approximately 80% vegetation cover.

Next to the RSPB viewpoint at W6Q7, there was a narrow 4 m band dominated by *Atriplex portulacoides* (~90% cover). On the south-western side, there was evidence of broken concrete at the edge of the RSPB viewpoint. Elsewhere, there was occasional *Phragmites australis* on the higher ground adjacent to the viewpoint.

From the RSPB viewpoint, travelling north-east, the established *Atriplex portulacoides* strip widened to 10 m and contained patches of *Tripolium pannonicum* with occasional *Spartina anglica* and *Salicornia europaea*, shown in Figure 12. This established patch has approximately 100% vegetation cover. Adjacent to the creek, there is an area of low marsh identical with mixed marsh *Tripolium pannonicum*, *Puccinellia maritima* and *Salicornia europaea* as was observed south-west of the RSPB viewpoint. In the creek that divides W5 from W6 (50°49'51" N, 0°16'54" W), scattered patches of *Salicornia europaea* were found which were approximately 3-5 m in diameter.

At the river end of this stretch at W6Q6 (50°49’53” N, 0°16’50” W), the marsh widens to 24 m and is dissected by a small creek. An established, 15 m wide area of *Atriplex portulacoides* was present in the upper areas, with a small (9 m) band of mixed *Puccinellia maritima*, *Salicornia europaea* and *Tripolium pannonicum* (~100% vegetation cover) along the river edge. At the river edge, there was evidence of erosion as a small cliff was present.



Figure 12:Vegetation running along the southern edge of the A259 in W6 from the RSPB viewpoint towards the river. On the left-hand side, the band of Atriplex portulacoides/Tripolium pannonicum can be seen. In the centre is the area of mudflat containing scattered patches of Salicornia europaea. Taken from 50° 49’ 51” N, 0° 16’ 54” W looking north-east, 13/10/21.

In the section north of the A259 adjacent to the Adur Outdoor Activity Centre at W6Q5 (50°49’55” N, 0°16’52” W), the salt marsh was highly degraded and in a poor condition due to boat moorings, with evidence of cars and trampling also present. The marsh here was 18 m to 21 m wide and was comprised of *Atriplex portulacoides* and *Tripolium pannonicum* (~50% vegetation cover) in the higher areas, moving to mixed *Spartina anglica* and *Salicornia europaea* (~20-50% cover) in the lower areas. Between the two slipways at W6Q4 (50°49’57” N, 0°16’55” W), a 4 m to 8 m wide patch of marsh was present. From high elevation to low elevation, this patch had a narrow 1 m band of *Atriplex portulacoides*, followed by a 5 m band of mixed *Salicornia europaea* and *Puccinellia maritima* and finally 1 m to 2 m of pioneer *Salicornia europaea* at the marsh edge.

North of the slipway by the recreation ground (50°49’57” N, 0°16’58” W), there was a narrow 2 m band of salt marsh which was recorded in W6Q3. This patch contained a mix of *Salicornia europaea* and *Atriplex portulacoides* with sparse vegetation cover. There was evidence of erosion, with the matting protecting the sea wall exposed in several areas. Moving towards the railway bridge, this patch widened into a banded area. Here there was a narrow 3 m to 4 m band of *Atriplex*

portulacoides at W6Q2 which was followed by a 4 m to 6 m band of mixed *Puccinellia maritima* and *Salicornia europaea* (~50-80% vegetation cover) at W6Q1 and finally a 0.5 m to 1 m band of pioneer *Salicornia europaea* at the river edge. At the river edge, there was evidence of erosion marked by a small cliff.

June 2022 surveys

Reach E2

Refer to appendix 2 for the location of the quadrats in reach E2.

Starting at the north of E2 at E2Q1 (50° 50' 2" N, 0° 16' 54" W), there was a patch dominated by *Atriplex portulacoides* (80% cover) which sits in an old wooden boat wreck. The condition of this patch was in a fair condition instead of good as bare ground was relatively high in this area (15%) compared to other mid-marsh areas across the estuary.

South of the boat wreck at E2Q2, there was a patch of patch of poor condition marsh, which sat adjacent to terrestrial shrub vegetation. The poor condition was due to the large amount of bare ground in this area (30%). The rest of the cover is dominated by low marsh species *Tripolium pannonicum* and *Puccinellia maritima* as well as filamentous green algae, which each covered 20% of the quadrat. This poor condition low marsh patch continued southwards along the rest of the unit across quadrats E2Q3-5 with similar species composition. Between the terrestrial shrub and the storm drain (50° 50' 1" N, 0° 16' 52" W), was an area dominated by *Salicornia europaea agg.* and bare ground, in equal proportions of 40%. Moving to the southern end of E2 towards the slipway (50° 49' 58" N, 0° 16' 48" W), the proportion of bare ground decreased to 15% while the proportion of *Salicornia europaea agg.* increased to 75%. The cover of other species stayed relatively consistent. Towards the southern end (50° 50' 0" N, 0° 16' 50" W), there was also evidence of erosion, which had begun to form a small cliff.

Reach W3

Refer to appendix 2 for the location of the quadrats in reach W3.

At the furthest eastern point of the W3 zone at W3Q1 (50° 49' 51" N, 0° 16' 4" W) there was a patch of poor condition salt marsh. The poor condition was a result of the patchy cover and frequent *Spartina anglica*. This area was dominated by a mixture of mostly low-marsh species, with most of the cover being *Salicornia europaea agg.* (35%), *Spartina anglica* (30%), and bare ground (25%). Towards the river, this patch was fronted by a slightly raised bank which had occasional, disconnected patches of *Atriplex portulacoides*. To the landward edge of the patch, there is an area of mudflat that extended to the sea wall. There was no change in the condition or dimensions of this area since the autumn 2021 survey.

Further west there is a small area of salt marsh between the two jetties at W3Q2 (50°49'50"N, 0°16'10"W). This area was fronted by a patch dominated by *Atriplex portulacoides* (80% cover)

which was in a fair condition. Approximately 3 m from the back from the area's riverside edge, *Atriplex portulacoides* had been lost and replaced with sparse *Suaeda maritima* with filamentous green algae covering the stems. There was evidence of erosion around the edge of the riverside half of the area that had produced a cliff, with the greatest erosion at the patches' north-eastern edge. Towards the back of the area, there were disconnected patches of low marsh vegetation. There was a transition from fair condition marsh at the riverside edge to poor condition marsh towards the sea wall which is likely caused by physical disturbance from the SATW works.

West of the two jetties at W3Q3 (50° 49' 49" N, 0° 16' 13" W), there was a patch of poor condition low marsh that extended from the western jetty to the western edge of the unit at the footpath. Cover across this area was extremely patchy, with disconnected areas of vegetation in mudflat. At the eastern end, this vegetation consisted mainly of *Salicornia europaea agg.* (85% cover), with sparse *Spartina anglica* (3%), *Tripolium pannonicum* (3%) and *Atriplex portulacoides* (1%). Towards the rear of this area there was a relatively dense patch of *Spartina anglica*. At the riverside edge, there was a band of pioneer *Salicornia europaea agg.* which is shown in Figure 13. This was not observed in previous surveys and was new growth on fresh sedimentary deposits.



Figure 13:Growth of pioneer vegetation on the riverside edge of W3. This growth was not observed in previous surveys. Taken from 50° 49' 50" N, 0° 16' 13" W looking north-west, 05/04/22.

The salt marsh surrounding Harbourside Coachworks (50° 49’ 49” N, 0° 16’ 16” W) was in a poor condition, which can be seen in Figure 14. This was seen in both W3Q4 and W3Q5 where, there was a large amount of bare ground (25% cover), with no dominant species; instead, there were relatively low proportions of *Puccinellia maritima* (30%), *Salicornia europaea agg.* (15%), *Tripolium pannonicum* (10%) and *Spartina anglica* (5%), which appeared to be competing for dominance. This poor condition was likely due to physical disturbances from boats moored in the area and thus not related to the SATW project. This highly disturbed, poor condition marsh continued towards the footpath, although the cover of *Salicornia europaea agg.* increases to 65%. At the riverside edge of the marsh adjacent to the footpath that marks the edge of the unit (50° 49’ 49” N, 0° 16’ 22” W) there was a large, approximately 30 cm cliff which had formed due to erosion and was not present in previous surveys. This cliff is shown in Figure 15 and is likely due to the natural erosion deposition cycle at the river edge.



Figure 14: Poor condition of the marshes at the western edge of the W3 zone. Taken from 50° 49’ 49” N, 0° 16’ 19” W looking south-west, 05/04/22.



Figure 15: Cliff that had formed due to recent erosion at the western edge of the W3 zone. Taken from 50° 49' 49.5" N, 0° 16' 21.432" W looking east, 05/04/22.

Reach W4

Refer to appendix 2 for the location of the quadrats in reach W4.

W4 consists of bands of vegetation. Alongside the sea wall (50° 49' 47" N, 0° 16' 23" W) there was a band dominated by *Atriplex portulacoides*, which was in a good condition. On the eastern side at W4Q2 (50° 49' 47" N, 0° 16' 22" W), *Atriplex portulacoides* accounted for 92% of the cover, despite its proximity to boats, which suggests they have minimal impact on this plant

community. Previous surveys found this patch had been in a poorer condition. This could have been due to elevated disturbance from the boats at the time. However, it is likely this improvement reflects the vegetation recovering from disturbance during the SATW works. Moving west of this band in W4 to W4Q4 (50° 49' 47" N, 0° 16' 25" W), the cover of *Atriplex portulacoides* decreased to 85%, although this was due to large amounts of filamentous green algae on *A. portulacoides*' stems (15% of the cover) rather than a decline in *A. portulacoides* and thus would still be considered to be in a good condition. This band of *Atriplex* is shown in Figure 16.



Figure 16: Band of Atriplex portulacoides at the rear of the W4 zone. Taken from 50° 49' 47.3" N, 0° 16' 25.1" W at W4Q4 looking west, 05/04/22.

Towards the river (50° 49' 48" N, 0° 16' 25" W), there was a band of mudflat that ranges from approximately 5 m to 15 m wide. Adjacent to this mudflat, there was a band of low-marsh species. On the eastern side at W4Q1 (50° 49' 48" N, 0° 16' 23" W), this patch was in a poor condition, with patchy cover caused by disturbance from the boats moored in the area. Bare ground and filamentous green algae formed a large component of the vegetated areas, with 20% and 25% cover respectively. No dominant species was present, likely due to disturbance, with *Salicornia*

europaea agg. (15%), *Tripolium pannonicum* (previously recorded as *Aster tripolium*) (15%), *Puccinellia maritima* (15%) and *Spartina anglica* (10%) found in near equal quantities. However, this disturbed condition had not changed since the previous survey and is unlikely to be the result of the SATW project. West of the footbridge (Adur Ferry Bridge) to quadrat W4Q3 (50° 49' 48" N, 0° 16' 26" W), this community improves to a fair condition, with no obvious disturbance. This area contained a large cover of algae (35%) and *Spartina anglica* (15%). *Atriplex portulacoides* was also common in this area, with a cover of 30% due to an ecotone between the algae/*Spartina* community and a band of *Atriplex portulacoides* along the river's edge.

The band of *Atriplex portulacoides* (60% cover) along the river's edge around W4Q5 (50° 49' 49" N, 0° 16' 26" W) was approximately 5 m wide and contained *Puccinellia maritima* (25%) and *Salicornia europaea agg.* (10%). As *Atriplex portulacoides* had not formed the dense 90+% cover seen in good condition areas, this area was determined to be in a fair condition. There was evidence of significant erosion along the marsh edge, which had produced an approximately 1 m tall cliff which larger than in the previous survey (0.6m).

Reach W6

Please refer to Appendix 2 for the location of the quadrats in reach W6.

At the northern end of the W6 zone, just south of the railway bridge (50° 50' 0" N, 0° 17' 6" W), there was a wide patch of salt marsh in a fair condition. The vegetation here was patchy, with notable amounts of bare ground. There was evidence of occasional trampling as well as occasional instances of *Spartina anglica* (approximately 5%). A mid-marsh band populated the higher, landward side of this patch at W6Q2, which was dominated by *Atriplex portulacoides* and *Puccinellia maritima* (both 40% cover) and had a lower cover of bare ground (5%). In the lower area towards the river at W6Q1, this band gave way to a low-marsh community dominated by *Puccinellia maritima* (40% cover), with large amounts of bare ground (30%) and *Salicornia europaea agg.* (20%). There was evidence of some erosion of the marshes' riverside edge.

Moving down-river there was a narrower (4 m wide) patch of vegetation at W6Q3, which extended down to the jetty. Cover here became increasingly patchy with large amounts of bare ground and condition became poor. This is partially due to a near complete lack of the mid-marsh community, with the cover of *Atriplex portulacoides* at 2%. Instead, this area was dominated by bare ground (55% cover), with *Puccinellia maritima* (20%) and filamentous green algae (15%) being the next most common. There was also occasional *Spartina anglica*, although this was not recorded in the quadrats. The poor quality of the marsh in this area is likely due to enhanced erosion as it is located at the outside of a meander in the river. This elevated erosion is evident in a) evidence of recent erosion observed at the time b) the steepness of the riverbank in the area, and c) the presence of exposed geotextile at the base of the sea wall.

Further down-river (50° 49' 56" N, 0° 16' 55" W), there was a patch of more robust vegetation between the two slipways. This patch was between 5 and 6 m wide and is in a fair condition. The

vegetation cover constitutes a narrow band of *Atriplex portulacoides* along the base of the sea wall that grades into *Puccinellia maritima* towards the river.

Directly adjacent to the Adur Recreation Centre at W6Q4 (50° 49’ 56” N, 0° 16’ 53” W) there was an area of fair condition marsh between the southern slipway and the pontoons. At the upper end, there was a 5 m wide band which is dominated by *Atriplex portulacoides* (80% cover). This transitioned into a 5 m band dominated by *Puccinellia maritima*. There was evidence of trampling across the site. Also, there was evidence of erosion at the marsh edge which had caused a small cliff to form. This erosion was more significant than in the areas to the north of the W6 zone, which was likely due to human activity adjacent to the Recreation Centre.

South of the pontoon at W6Q5 (50° 49’ 55” N, 0° 16’ 52” W) there was an area where boats were regularly moored as can be seen in Figure 17. The salt marsh in this area was in a poor condition with patchy cover. Bare ground accounted for 15% of the cover although the area was dominated by *Atriplex portulacoides* (50%). The poor condition of this marsh was likely due to physical activity disturbance around the moored boats, with evidence of vehicles (cars), which have also likely caused damage.



Figure 17: Moored boats adjacent to the Adur Recreation Centre. Aerial imagery is courtesy of the Channel Coast Observatory (www.channelcoast.org) and was taken on 20/09/2020.

Moving south of the A259 bridge (50° 49’ 53” N, 0° 16’ 51” W) there was a large patch of good condition salt marsh at W6Q6. This was dominated by *Atriplex portulacoides* (70% cover), although there was a relatively high species richness for salt marshes within the Adur estuary, with five species recorded. This includes *Spergularia marina*, which is relatively uncommon in the area, although this only constituted 1% of the cover.

Moving southwest towards the house boats parallel to the A259 (50° 49’ 47” N, 0° 17’ 3” W), the cover of *Atriplex portulacoides* increased to 95% and species richness reduces. This area south of the A259 was similar across the entire length and had seen no change since the 2021 survey.

Appendix 5: NVC floristic tables for Reach W7 (DOMIN scale and constancy values)

2019 surveys

Common name	*Scientific name*	T1Q1	T2Q4	T3Q7	T4Q10	T5Q13	T6Q16	T7Q19	T8Q22	T9Q25	T10Q28	T11Q31	Constancy values
Annual Sea blite	*Suaeda maritima*	4		5	5	4	5	4	4	5	3	2	V
Glasswort	*Salicornia europaea*	2	3	4	3	3	5	3	4	4	3	1	V
Sea aster	*Tripolium pannonicum*	4	1	4	4	2	4	3	1	3	2		V
Common salt marsh grass	*Puccinellia maritima*	1						1			4		II
Sea Couch	*Elymus athericus*	4		3			4	1			1	1	III
Sea purslane	*Atriplex portulacoides*	4		4	1	4	4	1	2	1	4	1	V
Lesser Sea spurrey	*Spergularia marina*	2								1			I
Spear leaved orache	*Atriplex prostrata*	4											I
Sea wormwood	*Artemisia maritima*						2				1		I
Litter		2	1	1	2	1	2	3	1	1	2	1	V
Bare ground		8	10	8	8	9	7	9	9	8	8	10	V

2020 surveys

Common name	Scientific name	T1Q1	T2Q4	T3Q7	T4Q10	T5Q13	T6Q16	T7Q19	T8Q22	T9Q25	T10Q28	T11Q31	Constancy values
Annual Sea blite	*Suaeda maritima*	5		5	5	5	4	7	5	3	5	1	V
Glasswort	*Salicornia europaea*	5	5	5	5	5	4	3	5	4	5	1	V
Sea aster	*Tripolium pannonicum*	3	1	3	1	2	2	1	2	4	1	1	V
Common salt marsh grass	*Puccinellia maritima*	1			1	1	1	4	5	1	1	4	V
Sea purslane	*Atriplex portulacoides*	4	1	1	1	2	1	1	1		1	4	V
Lesser Sea spurrey	*Spergularia marina*			4							4	1	I
Spear leaved orache	*Atriplex prostrata*							1					I
Common reed	*Phragmites australis*	2											I
Couch grass	*Elymus repens*	1					1	2	1				II
Algae						1		2		2		1	II
Litter		1		1	2	1		2	1	1	1		IV
Bare ground		7	9	7	7	8	8	7	7	8	7	8	V

2021 surveys (quadrat 28 missing)

Common name	Scientific name	T1Q1	T2Q4	T3Q7	T4Q10	T5Q13	T6Q16	T7Q19	T8Q22	T9Q25	T11Q31	Constancy values
Annual Sea blite	*Suaeda maritima*			4	4	4	1	1	1	2	3	IV
Glasswort	*Salicornia europaea*	1		5	5	4		1	5	7	5	IV
Sea aster	*Tripolium pannonicum*	1	4	2	4	5	2	4	1	1		V
Common salt marsh grass	*Puccinellia maritima*	8	4	6	7	8	8	4	1	1	5	V
Sea Couch	*Elymus athericus*	8	4		4		5	4				III
Sea purslane	*Atriplex portulacoides*	4	4	4	4	5	5	3	5	3		V
Lesser Sea spurrey	*Spergularia marina*		4						1	1	1	III
Spear leaved orache	*Atriplex prostrata*	1										I
Moss		1										I
Litter		4	1			2		1	1	1	1	III
Bare ground		1	3	1		1	2	1	1	1	1	V

2022 surveys

Common name	Scientific name	T1Q1	T2Q4	T3Q7	T4Q10	T5Q13	T6Q16	T7Q19	T8Q22	T9Q25	T10Q28	T11Q31	Constancy values
Annual Sea blite	*Suaeda maritima*		1	1	1	1		1	1	3	5	5	V
Glasswort	*Salicornia europaea*		4	3	1	2		1	2	4	1	4	V
Sea aster	*Tripolium pannonicum*	1	2	4	4	5		4	1	1			IV
Common salt marsh grass	*Puccinellia maritima*	4	7	4	6	8	1	8	7	7	3	2	V
Sea Couch	*Elymus athericus*	4	3	4		1	5	4					III
Sea purslane	*Atriplex portulacoides*	8	5	7	5	3	8	4	4	4		2	V
Lesser Sea spurrey	*Spergularia marina*	4	1	1	1					1	1		III
Sea wormwood	*Artemisia maritima*						4						I
Common reed	*Phragmites australis*	2											I
Sea plantain	*Plantago maritima*			1									I
Litter		1	1	1	1	1	1	1		1	1	4	V
Bare ground		5	5	7	7	4	2	1	8	6	9	8	V

2023 surveys

Common name	Scientific name	T1Q1	T2Q4	T3Q7	T4Q10	T5Q13	T6Q16	T7Q19	T8Q22	T9Q25	T10Q28	T11Q31	Constancy values
Annual Sea blite	*Suaeda maritima*					2				2	4	1	II
Glasswort	*Salicornia europaea*		5	1	4	3		3	4	1	1	4	V
Sea aster	*Tripolium pannonicum*	1	3	4	4	5		4	1	2	1		V
Common salt marsh grass	*Puccinellia maritima*	5	5	7	8	8	2	8	4	9	3	2	V
Sea Couch	*Elymus athericus*	5		2			9						II
Sea purslane	*Atriplex portulacoides*	6	5	6	4	4	4	5	4	4	1	3	V
Lesser Sea spurrey	*Spergularia marina*	3	4	1				1		1	1		III
Sea wormwood	*Artemisia maritima*						4						I
Common reed	*Phragmites australis*	2											I
Litter					1		3	1		1	1		III
Bare ground		4	5	4	5	5	4	3	9	4	9	9	V

2024 surveys

Common name	Scientific name	T1Q1	T2Q4	T3Q7	T4Q10	T5Q13	T6Q16	T7Q19	T8Q22	T9Q25	T10Q28	T11Q31	Constancy values
Annual Sea blite	*Suaeda maritima*		1	1	2	3		1	1	3	3	2	V
Glasswort	*Salicornia europaea*		2	1	3	4			2	3	2	4	IV
Sea aster	*Tripolium pannonicum*		4	2	5	5		4	2	2	2		IV
Common salt marsh grass	*Puccinellia maritima*		9	4	7	8		9	7	9	4	7	V
Sea Couch	*Elymus athericus*	7		2	3		8	1					III
Sea purslane	*Atriplex portulacoides*	6	1	9	5	2	5	3	5	2		4	V
Lesser Sea spurrey	*Spergularia marina*										5		I
Spear leaved orache	*Atriplex prostrata*										2		I
Sea wormwood	*Artemisia maritima*						3						I
Common Reed	*Phragmites australis*	4											I
Slender barb grass	*Parapholis strigosa*	2		1		2		2	1	1		4	IV
Curved hard grass	*Parapholis incurva*										2		I
Annual beard grass	*Polypogon monspeliensis*										4		I
Greater Sea spurrey	*Spergularia media*	4	2	1	2	2		2	1	2		2	V
Algae					2	2						1	II
Litter		1	1	2	1	1	1	1	2	1		1	V
Bare ground		4	3	1	4	4	1		5	3	8	7	V

Table 8: Summary of quadrat surveys for the New saltmarsh, Establish upper and establish lower using the DAFOR scale for 2019 and 2024. Direction of change in abundance and/or frequency is between 2019 and 2024 is represented by: = no change; ↗: increase ; ↘: decrease.

	New 2019	New 2024	Change	Lower 2019	Lower 2024	Change	Upper 2019	Upper 2024	Change
Species recorded	Frequency			Frequency			Frequency		
Salicornia europaea	R	F	↗	D	A	↘		R	↗
*Spartina anglica**					O	↗		R	↗
Tripolium pannonicum	A	F	↘	A	A	=	O	O	=
Suaeda maritima	A	A	↘	R	F	↗		R	↗
Puccinellia maritima	O	D	↗	D	D	↗		R	↗
Atriplex portulacoides	A	D	↗	D	F	↘	D	D	↗
Spergularia marina	R	R	↗						
Artemisia maritima	R	R	=						
Elymus athericus	F	F	↗						
Atriplex prostrata	R	R	=						
Algae					A	↗		A	↗
Plant Litter	A	A	=	A	A	=	A	A	=
Bare ground	D	D	↘	A	A	↘	A	A	↘

Appendice 6: Example of area at 1:200 scale used for manual digitisation

