Lymington Harbour Commissioners

Beneficial Use of Dredged Sediment to Improve Boiler Marsh, Lymington

Review of restoration activities and monitoring undertaken for the first trial campaign in 2024

February 2025

Innovative Thinking - Sustainable Solutions

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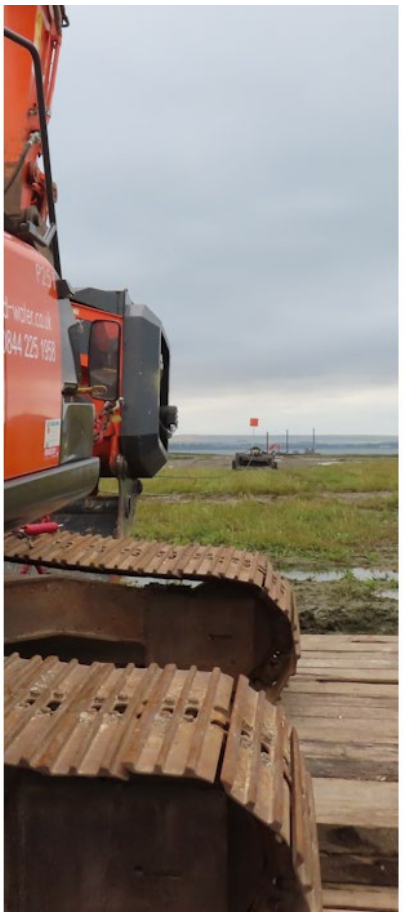


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Acknowledgements

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1 Introduction

1.1 Project background

This monitoring report has been produced to inform the Marine Management Organisation (MMO) and the Environment Agency about the progress being made with the saltmarsh restoration work consented under MMO Marine Licence L/2023/00294/1. It is produced in fulfilment of an agreed monitoring programme (produced under Conditions 5.2.19 and 5.2.20 of the licence) and describes findings from the first campaign, as undertaken in September 2024, and the results of surveys undertaken to assess the effectiveness and value of that campaign.

Marine Licence L/2023/00294/1 provides consent for Lymington Harbour Commissioners (LHC) to restore of up to ten hectares (ha) of saltmarsh on Boiler Marsh island which lies at the entrance to Lymington Estuary (see Figure 1 and Image 1). Under this licence, LHC is working with Land and Water Services Ltd (LAWS), the Hampshire and Isle of Wight Wildlife Trust (HIWWT) and other stakeholders to raise the bed elevation of an ecologically deteriorating central part of the island.

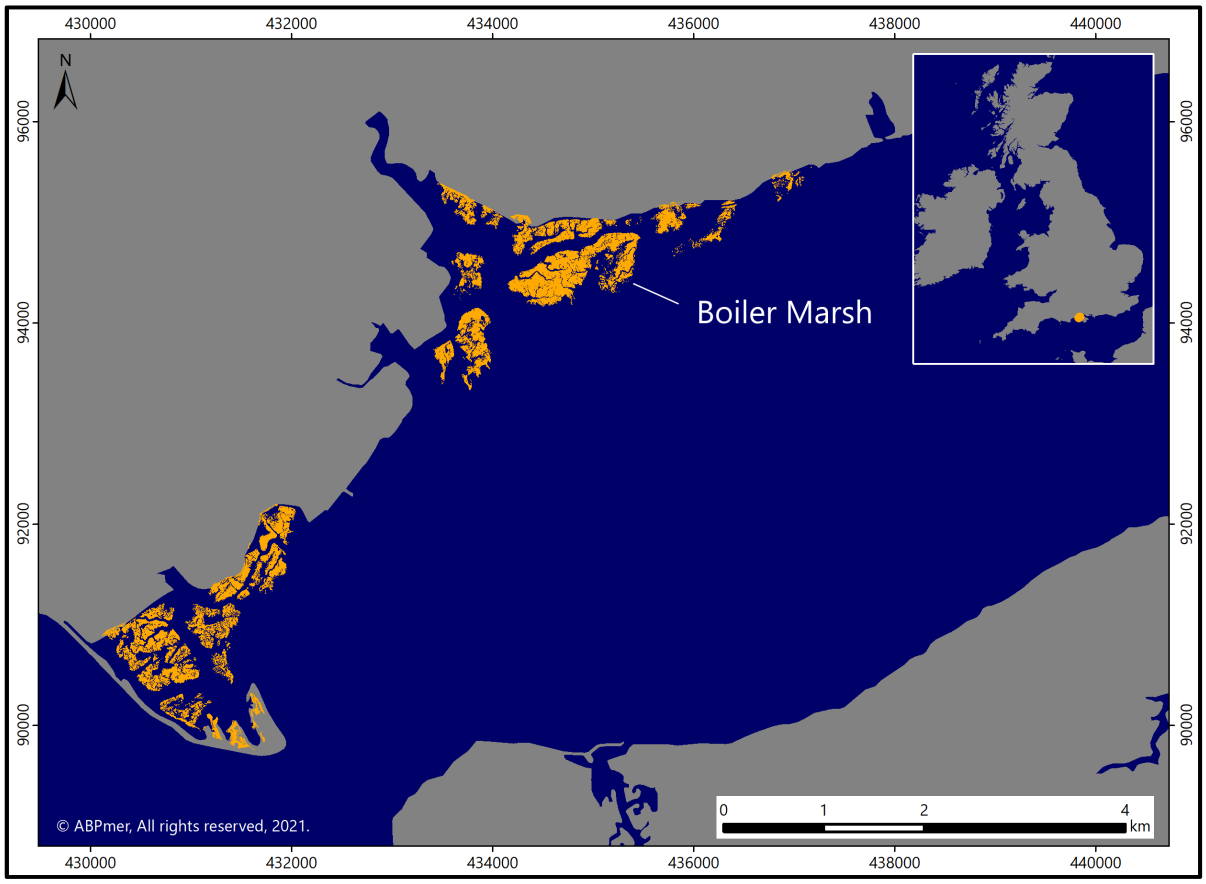


Figure 1. Location of Boiler Marsh at the entrance to Lymington Harbour

This restoration area was once covered in saltmarsh plants but is now unvegetated and in an ecologically poor condition. To return vegetation to this area, dredged sediment is being used to raise the intertidal bed level so that it matches, or even exceeds, the height of the surrounding healthier marsh. The intention is to expand the healthier vegetated marsh and provide much needed habitat for breeding seabirds as well as help delay the loss of this large eroding marsh island.

Source Landwatch UAV survey for Solent Forum (February 2019)

Image 1. View of Boiler Marsh in front of Lymington Harbour

To emphasise the value of the site for breeding birds, during 2023 Boiler Marsh supported 27% of all nesting adult birds in the Solent (ABPmer, 2025). As such, it is one of two island complexes (with South Binness in Langstone Harbour) which are hugely important for breeding seabirds[1].

This analysis of Boiler Marsh breeding bird numbers was based on surveys undertaken by Hampshire County Council (HCC). For these surveys, HCC separately count nests across the west half of the island (referred to by HCC as the 'Boiler' count area) and the eastern half (called the 'Pylewell' count area) as shown in Figure 2. The bird nesting records from both these count areas were then treated as one full 'Boiler Marsh Island' count in the ABPmer (2025) review.

By surveying the eastern and western sides of the island separately, the HCC results show how breeding birds on Boiler Marsh are under threat as the habitat degrades. The HCC surveys show that most nests are now confined to the higher remaining parts on its eastern side (the Pylewell count area). The rest of the island to the west has, like other west Solent marshes, become too low in the tidal frame, and flooded too often, to support many nesting birds

This disparity between the east and the west of the island was more recently verified by surveys undertaken last year (HCC, 2024). During these surveys, 3,110 active Black-headed Gull nests were found on the eastern side of the island but there were none on the west for the first time. By contrast there were 12 pairs of Common Tern on the west side (these were probably confined to the occasional raised shingle bars/cheniers in this area) but only four pairs were in the east. However, it is now very clear that the eastern half of the island is becoming increasingly untenable as a breeding seabird site.

[1] The analyses from 2023 showed that 87% of seabirds (especially Sandwich Tern, Black-headed Gull and Mediterranean Gull) were breeding on the saltmarsh and shingle islands of the Solent. These two island complexes were found to be particularly important (Boiler Marsh accounted for 27% and South Binness island 45%) (ABPmer, 2025).

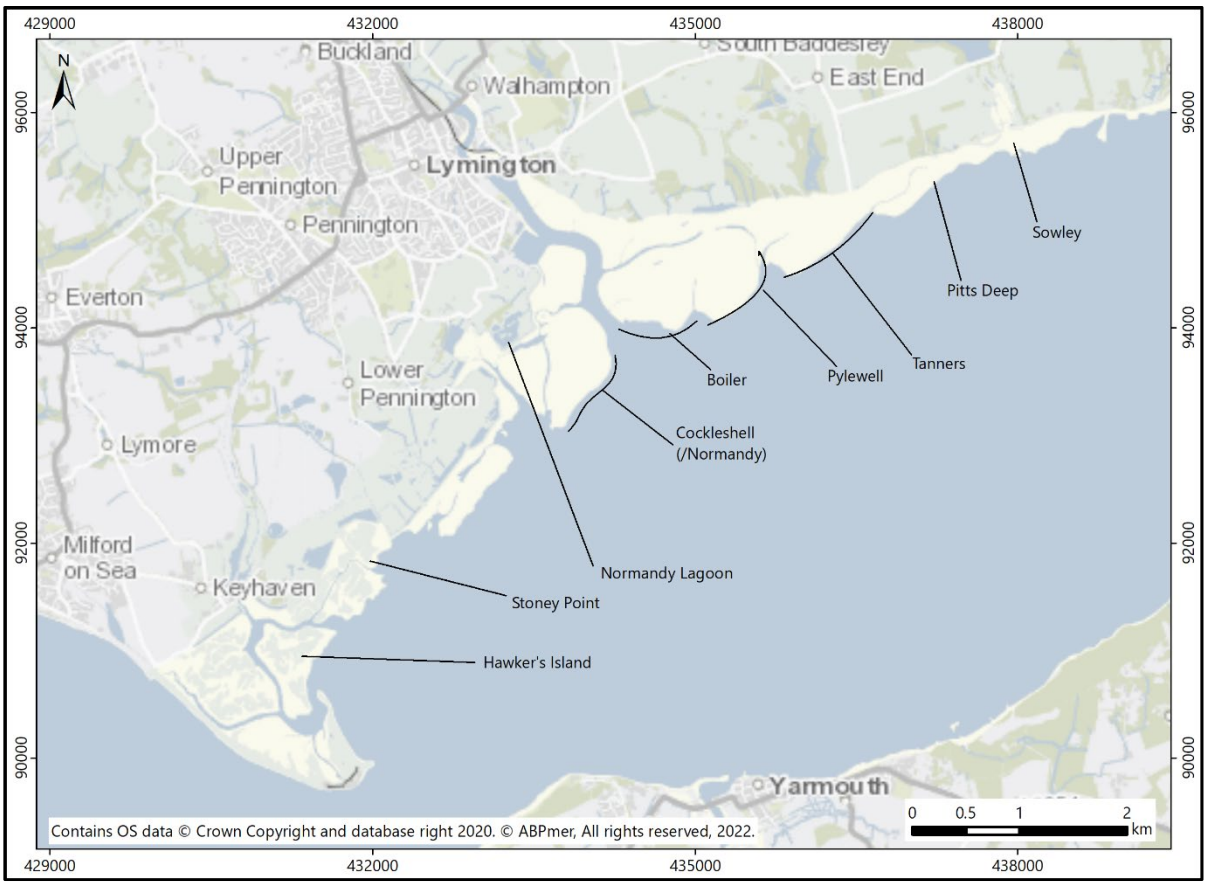


Figure 2. Count areas covered by HCC's annual waterbird surveys

The approach being taken for this habitat restoration is unique. It involves using dredged sediment that has been, and will be, placed in front of Boiler Marsh (as consented under separate MMO marine licences L/2014/00396/2 and L/2024/00260/1). This sediment is placed at a licenced deposit ground at the lower lying seaward edges of Boiler Marsh using a 'bottom placement' approach. For this approach, sediment is dropped directly from split hopper sediment transport barges that can access upper mudflat habitat at high water on larger spring tides.

This new deposit ground has been licensed for sediment placement since 2017 (after initial trials from 2014 to 2016). And, each year, the LHC places several thousand more cubic meters at this location. After 10 years, this regularly placed sediment has accumulated and a mound of sediment has built up which is providing protection to marsh island behind. The most recent licence for this activity (L/2024/00260/1) now allows for this deposition to continue until the end of 2034 and for up to 20,000 wet tonnes (around 17,500 m^3) to be placed annually.

For the new marsh restoration project (under L/2023/00294/1), some of this deposited, and now consolidated, dredge sediment is being moved from the placement site to higher intertidal areas. The first campaign for this was undertaken in September 2024 (after equipment mobilisation in August).

For this first campaign the sediment movement was done using a new Saltmarsh Restoration Drag Box (SRDB) technique. This technique involves drawing a steel 'drag box' with load bearing skis along a winch line from the low to the high shore. The winch line is held between pulleys on a spud barge moored temporarily to seaward of the dredge sediment placement area and an excavator positioned on the landward side of the receiving/restoration site (see Image 2).

As noted above, this bed raising is being done to allow marsh plants to recolonise the area and expand the amount of remaining healthy marsh on the island. This will enhance local biodiversity and is expected to provide valuable habitat for breeding waterbirds. The aim of the project is also to slow the rate at which the marsh is broken up and lost through erosion and sea level rise while also learning new lessons about how to best use dredged sediment in a beneficial way.

Source ABPmer (September 2024)

Image 2. Central and west side of Boiler Marsh during the drag box activities

1.2 Monitoring conditions

As outlined above, Marine Licence (L/023/00294/1) as issued by the MMO provides consent for this restoration project subject to appropriate conditions. These conditions include the following which relates to production of this monitoring plan:

- **Condition 5.2.19.** Requires that '*a finalised monitoring programme must be submitted to the MMO no later than six weeks prior to the commencement of works. This monitoring programme must be adhered to throughout the lifetime of the licence, unless otherwise agreed in writing by the MMO. Any amendments to the Monitoring Programme must be submitted to the MMO 10 weeks prior to the changes being implemented. All amendments need written approval from the MMO. **Reason**: To ensure monitoring of progress of the project is being undertaken to indicate whether it has been successful or not*".

In addition, there are three other conditions that relate to monitoring. These include a requirement to deliver monitoring reports in a timely manner and to carry out a particular survey approach as follows:

- **Condition 5.2.5:** This states that a "*baseline (photographic or other method) survey of the site must be undertaken prior to the licensed activities commencing. This must be done before each campaign across the ten-year licence period. This must be submitted to the MMO within 10 working days of the survey being collected. **Reason**: To understand the baseline conditions at the site prior to sediment recharge*".
- **Condition 5.2.20:** This requires that "*All Monitoring Reports from the surveys submitted under condition 5.2.19 (or any agreed amendment) must be submitted to the MMO for review no more than four weeks after the completion of each report. **Reason**: To monitor progress of the project and indicate whether it has been successful or not.*; and

- **Condition 5.2.22**: This requires that "*A further repeat survey (photographic or other method) of the site must be undertaken no later than ten working days after the licensed activities have been completed. This must be done after each campaign across the ten-year licence period. The survey with a written report must be submitted to the MMO within ten working days of the survey being collected. **Reason**: To ensure damage to intertidal area is limited and temporary structures have been removed to promote recovery*".

In fulfilment of Condition 5.2.19, a monitoring plan was produced and issued to the MMO at the end of May (ABPmer, 2024a). This monitoring programme is being carried out from July 2024 to December 2025. This will capture the lessons from immediately after the first restoration campaign in 2024 and will assess the effectiveness of the restoration some 12 months later.

As required under this agreed monitoring plan, this report is an end of calendar year review that describes the results of survey work undertaken before, during and after the 2024 campaign. It also outlines some of the key the lessons learned from this first phase of work. The location of this Phase 1 restoration area for the 2024 campaign is shown in Figure 3.

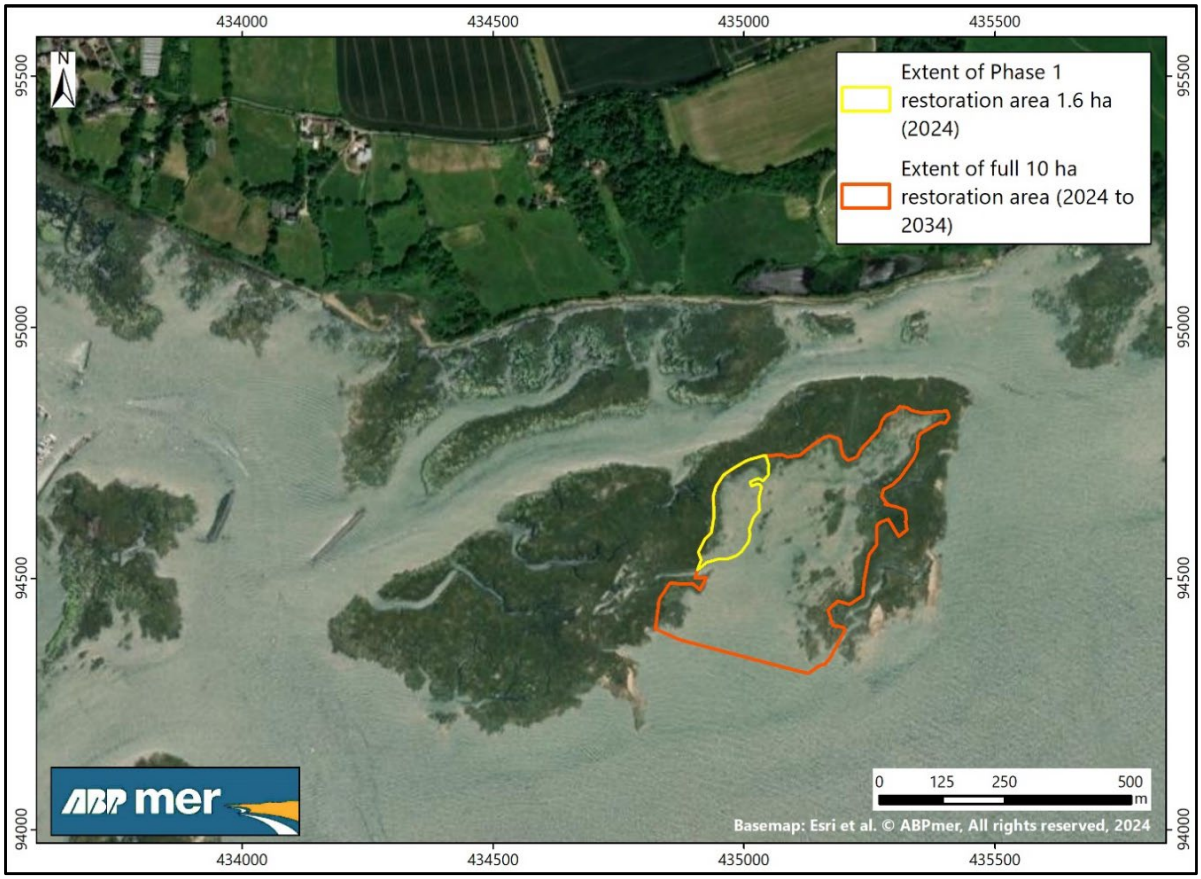


Figure 3. Extent of the Boiler Marsh restoration areas

In addition to the annual review provided in this report and the monitoring plan report, two other reports were prepared and issued to the MMO (ABPmer 2024b, 2024c). These provided a photographic record of the restoration site and the surrounding marsh before and after the 2024 campaign (as required, respectively, under Condition 5.2.5 and 5.2.22 cite above). Further detail about these surveys, and the other monitoring work undertaken during 2024, are provided in the following section.

2 Methods

2.1 Introduction

To accompany and inform the restoration work a range of field surveys were undertaken before, during and after the restoration work. The core monitoring and review tasks for this first campaign in 2024 are described in the sections below. These tasks include those carried out to fulfil the requirements of the MMO licensing conditions and inform the Environment Agency (as a key funder of the project) about effectiveness and outcomes of the work[2].

2.2 Before the restoration

In advance of the 2024 restoration campaign, and before any mobilisation of equipment or licensed activities began on site, two site visits were undertaken (in June and July 2024) by LHC and ABPmer. This is in addition to preparatory visits also carried out by LAWS and LHC. The first of these was a fact-finding exercise to inform project implementation. The second was carried out to obtain a baseline fixed-point photographic record of the restoration area and surrounding marshes before the works began (to fulfil MMO Condition 5.2.5).

During the July visit both ground level and aerial photographs (latter using a DJI mini 2 drone) were taken from fixed points across Boiler Marsh. The locations of these sites are shown in Figure 4. A report of this July visit (ABPmer, 2024b) was issued to the MMO on 02 August 2024.

2.3 During the restoration

While the restoration work was underway, ABPmer carried out a saltmarsh survey to describe the vegetation cover around the restoration area. This was undertaken on 9 September 2024.

During this survey, the percentage cover of marsh plants was recorded at the six established quadrat recording locations (Sites Q2 to Q7). An example of one quadrat sampling site is shown in Image 3; and the site locations are illustrated in Figure 5.

These sites were set up and previously surveyed in 2022 for the baseline review that accompanied the marine licence application for this project (ABPmer 2023). The intention is for them to be used as fixed sites for longer term monitoring of the area surrounding the restoration zone. Also, new quadrat recording sites will be added within the restoration areas over coming years, when this relocated sediment has consolidated that the site is safe to access.

At these six quadrat locations, a record was taken of percentage cover of each plant species present. Also, the position and bed elevation of each quadrat corner was taken using RTK GPS (see Image 4). These RTK measurements provide information on the range of bed elevations at each site and will also be used in future years to both record and accurately relocate the quadrat locations.

Alongside marsh plant monitoring further photographic records of the area were taken. Also, extra experimental 3D topographic and photogrammetric mapping measurements were taken around two fixed point locations to ground truth the bed elevations at selected sites. This was done by ABPmer

[2] In addition to this core work, independent research was undertaken on this site in 2024 by the University of Essex and Bangor University for separate studies into the value of saltmarsh restoration. This work will be published separately.

using a GeoSLAM 3D Light Detection and Ranging (LiDAR) and photogrammetry scanner (see Image 5). These extra GeoSLAM readings were taken, in large part, to explore the value of using this approach on saltmarsh habitats.

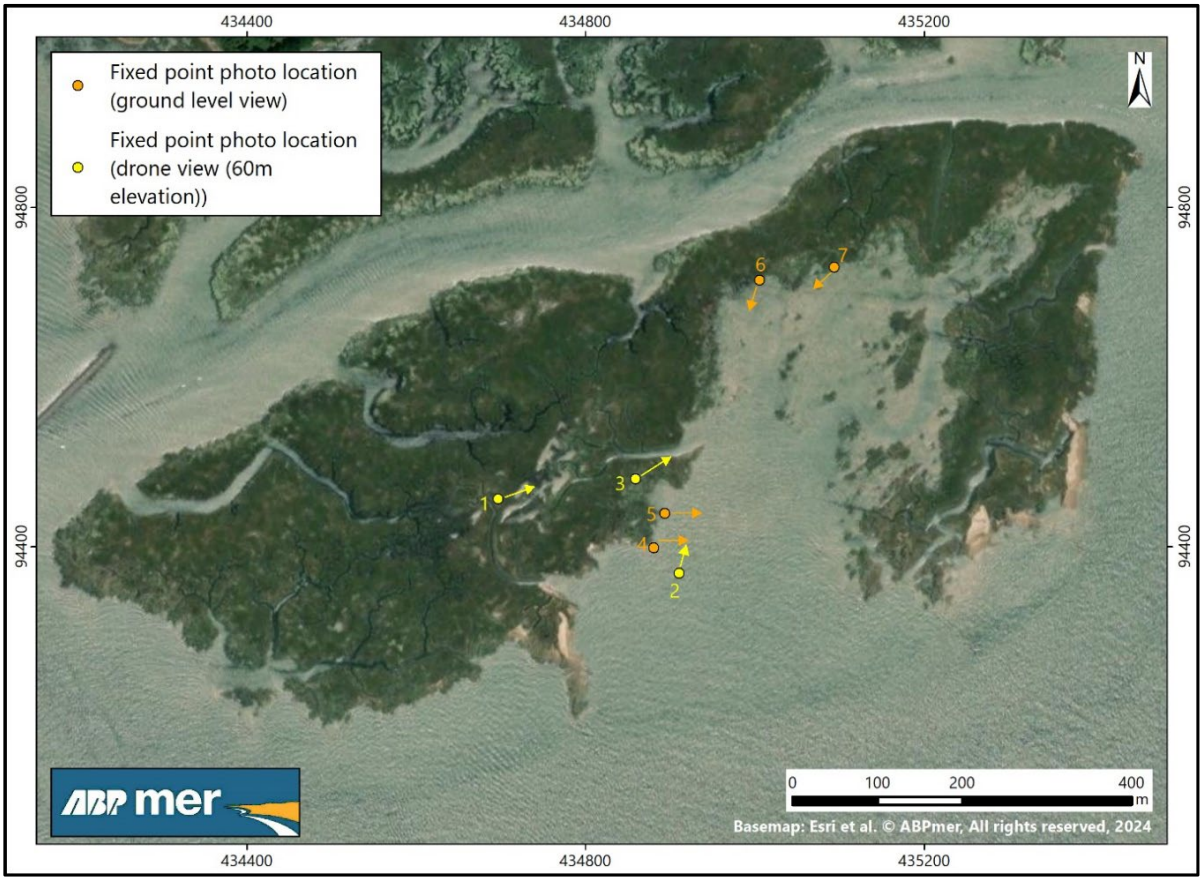
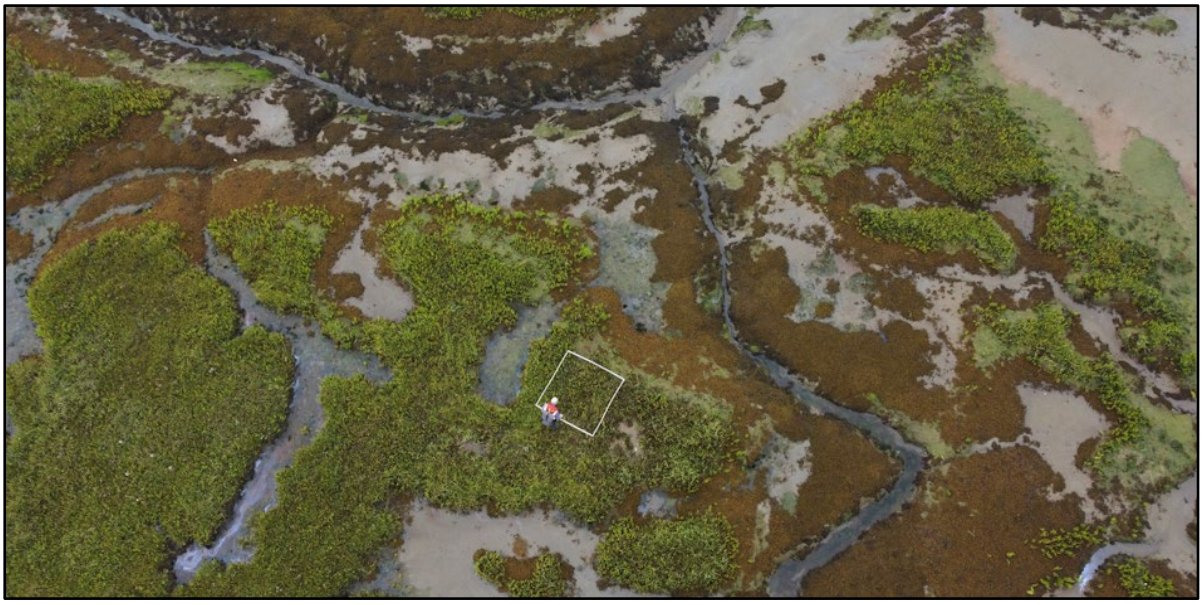


Figure 4. Location and direction of photographs taken on Boiler Marsh (July 2024)



Source ABPmer (September 2024)

Image 3. Aerial view of 4 m² quadrat site for recording saltmarsh plant cover

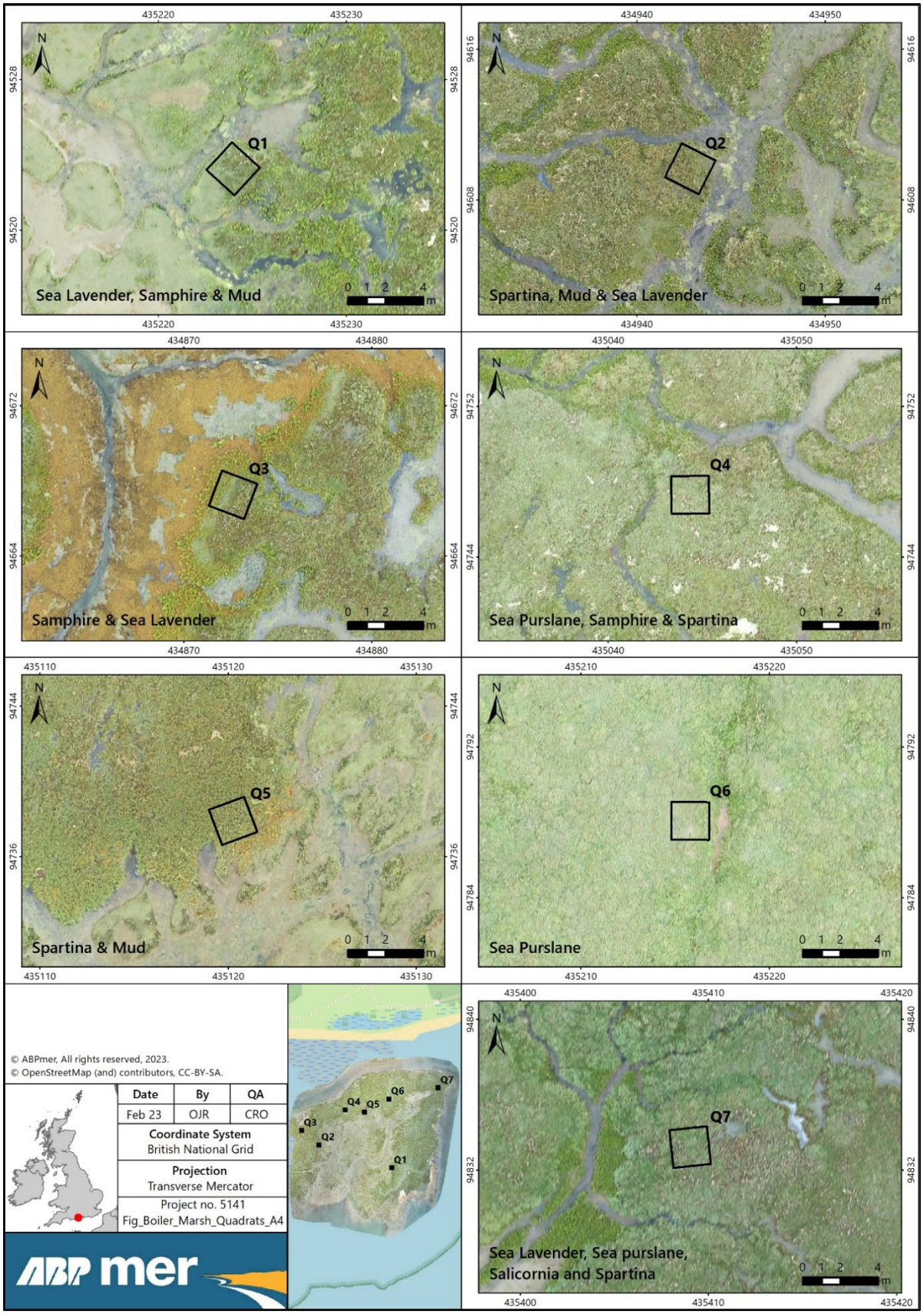


Figure 5. Quadrat site positions with aerial imagery showing habitat types (July 2022)

Source ABPmer (September 2024)

Image 4. Position and elevation recording of corners at quadrat Site Q4

Source ABPmer (September 2024)

Image 5. GeoSLAM 3D LiDAR topography and photogrammetry mapping at Site Q3

2.4 After the restoration

Shortly after the restoration work was completed, Shoreline Surveys Ltd carried out combined bathymetry and aerial/drone topographic surveys of the site to describe the bed elevations across the restoration area. These surveys were undertaken on 2 October 2024 to describe the changes in intertidal elevations following the 2024 campaign (as required under the monitoring plan that was issued in fulfilment of Condition 5.2.19).

The areas covered by these bathymetry and topography surveys encompassed both the dredge sediment placement site from which sediment was excavated and the restoration area where this sediment was moved to. Thes areas are shown in Figure 6 alongside the area which is licensed for separate bottom placement.

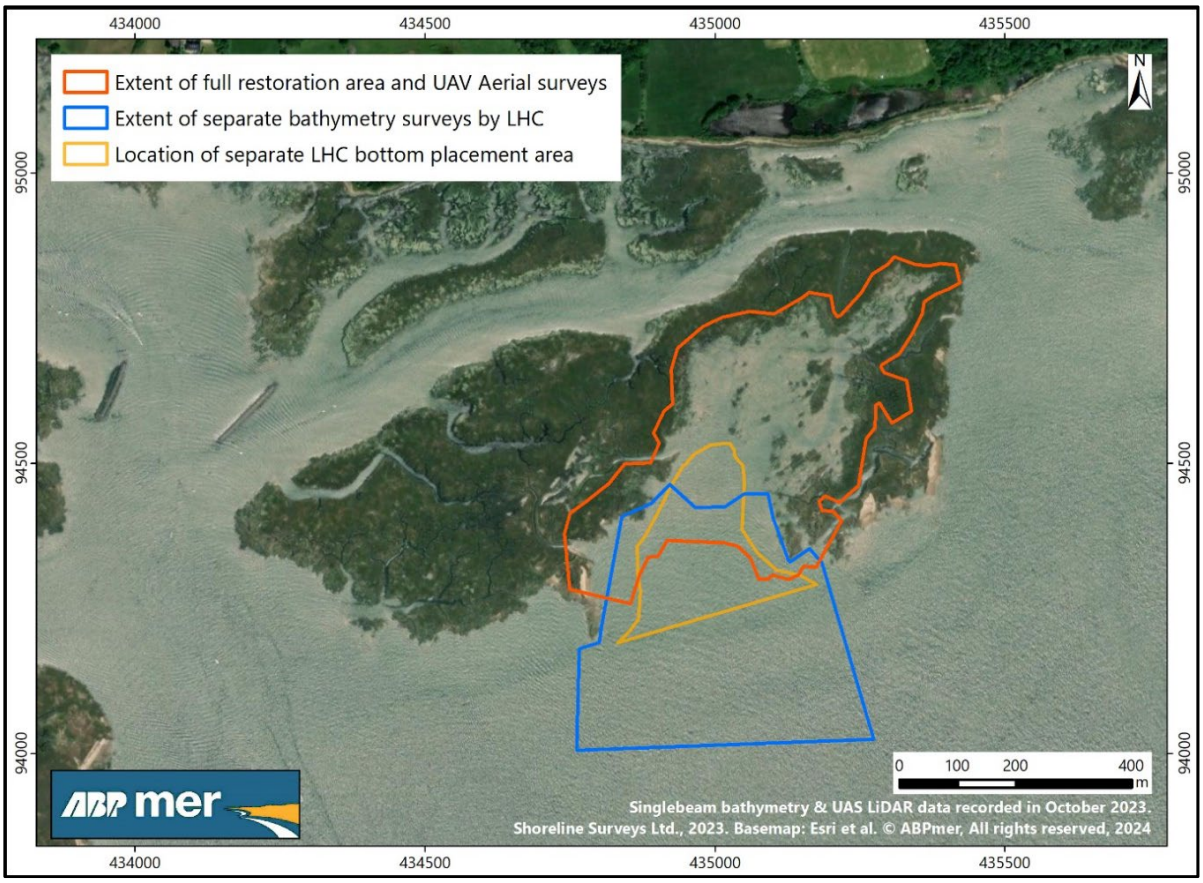


Figure 6. Areas covered by the topography and bathymetry surveys

In the days just after the restoration work was completed, ABPmer also carried out a further site visit, on 8 October 2024. This was undertaken to collect fixed-point photographs to verify that any damage to intertidal area was limited and that any temporary structures had been removed (for MMO Condition 5.2.22)[3].

As with the pre-restoration July visit, both ground level and aerial photographs were taken from points across Boiler Marsh. The locations of these site are shown in Figure 7. A report of this visit (ABPmer, 2024c) was issued to the MMO on 11 October 2024.

[3] To also fulfil this, a post-restoration photographic record was issued to MMO (ABPmer 2024c) after the October visit,

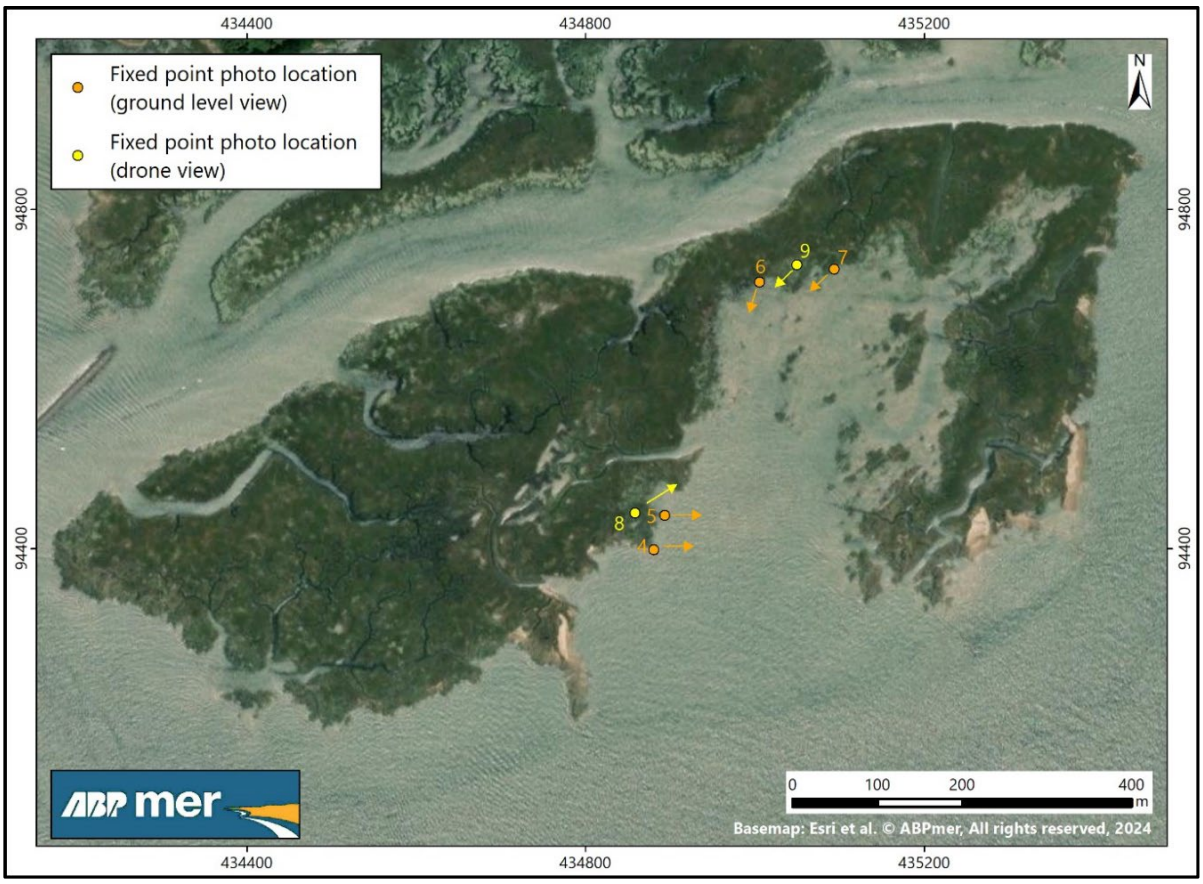


Figure 7. Location and direction of photographs taken on Boiler Marsh (October 2024)

2.5 Site visits and review meetings

In addition to the core field survey work described above, further surveys, site visits and meetings were undertaken by the Environment Agency, and other interested parties to review the project outcomes and lessons. This included meetings of the project Steering Group which were held on 23 September (to review project progress during the latter stage of the 2024 campaign) and on 19 February 2025 (to review project outcomes, monitoring results and the plans for a second campaign in 2025). This Steering Group includes representatives from the Environment Agency, Natural England (NE), and the Hampshire and Isle of Wight Wildlife Trust (HIWWT). Meetings of this group were undertaken as part of the governance arrangements for the Environment Agency grant funding and in keeping with the monitoring plan requirements.

A further technical review meeting was held on 29 October 2024 between the Environment Agency, LHC, LAWS and ABPmer. These discussions were used to collate lessons from the project to both inform this monitoring report and also, based on these findings, inform the plan for a proposed second campaign in 2025.

In addition, separate surveys and research work was undertaken during 2024 by the Centre for Ecology and Hydrology (CEH) and Bangor University which were supported by LHC, LAWS and ABPmer. The CEH surveyed ten saltmarsh sites on Boiler Marsh in August 2024. This CEH survey was undertaken to inform a wider study with the University of Essex for the Blue Marine Foundation on the value of saltmarsh restoration project. Bangor University separately collected samples from the site for analysis of nutrient processing in saltmarsh habitats. The results from these studies will be published separately and do not form part of the monitoring report requirements approved by the MMO.

3 Results

3.1 Introduction

The results of the monitoring work and outcomes of the first restoration campaign are described in the following two sections. The first section (Section 3.2) reviews how the work progressed and explains the technical challenges that were encountered for this first trial. This section also describes how much sediment was moved and the bed elevation heights that were attained once the work was completed (using the bathymetric and topographic survey results).

Following this review, Section 3.3 describes the findings from the saltmarsh survey. As described above, this survey was undertaken across the marshes surrounding the restoration areas to describe the plant assemblages and the habitat conditions and, also, to ground-truth the bed elevations in these areas against the topographic survey data. On this occasion, the restoration site itself was not surveyed directly because it is not safe to access this area yet. This may be possible once the introduced sediment has settled, consolidated and stabilised. Also, it will take at least full autumn to early summer cycle for plants to seed to begin growing in the restored areas.

3.2 Restoration outcomes

The habitat restoration activities for this first trial were undertaken during September 2024. This followed a period of equipment mobilisation from late July to the end of August. During this period several difficulties and delays were encountered. These challenges included the following:

- The soft terrain on the marshes, clay platforms and muds meant that working conditions were difficult and that equipment such as the original amphibious excavator could not operate effectively or safely;
- Regular severe storms were experienced during the mobilisation and implementation periods which hampered and halted progress. On site in August, there were around 20 days where wind speeds reached Force 6. There were a further 11 such days in September;
- The drag box did not operate well on this soft and undulating mud terrain and had to be adjusted to widen the ski's and reducing sinking into the substratum. Its tailgate also had to be adjusted to prevent the box "hauling back" sediments during its return cycle;
- The winching mechanism and rope strength had to be upgraded to account for the strain that was being placed on the equipment from hauling the drag box over a relatively long distance and over an undulating terrain; and
- Work had to stop on 29 September 2024 to adhere to the working period set out in the marine licence. This work could have technically continued but a maximum working period of four weeks is provided for under the consent.

For these reasons, the amount of sediment that could be moved from the dredge disposal area into the restoration area was relatively small. On completion of the work only 806 m^3 was calculated to have been moved into the restoration area. This compares with 9,000 m^3 which it had been hoped would be moved on this occasion (from a total resource of around 50,000 m^3 that is potentially available at the dredge disposal location). Most of that sediment was moved in the latter stages (last few days) of the working window once the early difficulties had been overcome.

This estimate of the volume moved was obtained from calculations made by Shoreline Surveys Ltd. who compared bed elevation maps from April and October 2024 (see Appendix A). This analysis showed that the volume moved was 1,493 m^3. Of this 806 m^3 was placed within the restoration zone while 687 m^3 was placed in close proximity. An equivalent comparison of the April and October 2024 surveys showed that the volume excavated from the dredge placement area was 1,647 m^3.

The relocated dredge material was placed in two discrete areas. One was located at the northernmost side of the restoration area and the other placed further to the south. This northernmost area was created during the initial stages of the works at which time the largest possible haulage distances were being tested. The latter area was created towards the end of the campaign when the distances were shortened to accelerate the rate of sediment movement.

These two areas, as well as the regions where the excavation occurred are illustrated in Figure 8 which shows the areas of bed elevation differences in the restoration areas between April and October 2024. To also illustrate the outcomes on site, an aerial view of the whole working area after the trial was completed (as taken on 8 October 2024) is shown in Image 6.

On completion of the works, the sediment that had been moved to the northernmost area raised the bed height up to 1.64 m ODN (or 3.62 CD). This is around 1 m above the clay platforms on which the material was placed and over 0.5 m above the MHWS elevation. As a result, this small mound became the highest point on Boiler Marsh (with the possible exception of some of small chenier crests) and was the only part of the marsh that was still visibly exposed on some spring tide (3 m CD) high waters. The lower of the two placement areas had, on completion of the works, a crest height of 0.96 m ODN (or 2.94 CD). That means it was lying above mean high water neap tide elevation (which is 2.6 m ODN).

These outcomes and the extent of the main working areas and restoration outcomes are also shown on Figure 9 which presents an enhanced topographic map of the site produced by ABPmer using data collected on 02 October 2024 by Shoreline Surveys Ltd. On this map it is possible to clearly see the well raised northernmost area of placed sediment as well as the excavation zone and the drag box tracking marks between. The other area of sediment build up is not clearly distinguishable relative to the surrounding topography.

At the new bed elevations achieved on the northernmost area, marsh plant recolonisation may well now take place. It is less likely to occur at the southernmost area because of its lower elevation combined with greater wave exposure. However, in the weeks and months since the work was completed, the placed sediment in both areas will have settled, compacted and lowered in elevation. They will also have been affected by the winter storms over subsequent months. The extent of this settlement, and the level of initial plant colonisation will be explored during the 2025 monitoring campaign.

In conclusion, although the trial successfully increased the elevation of poor-quality marsh, the restored area was significantly smaller than was hoped for with the trial highlighting both the benefits and potential of the new technique, but also the challenges of habitat restoration in the marine environment. From this trial several important lessons were learned which will now be taken forward to refine and develop the equipment, work methodologies and the MMO marine licence parameters to enhance outcomes for future projects.

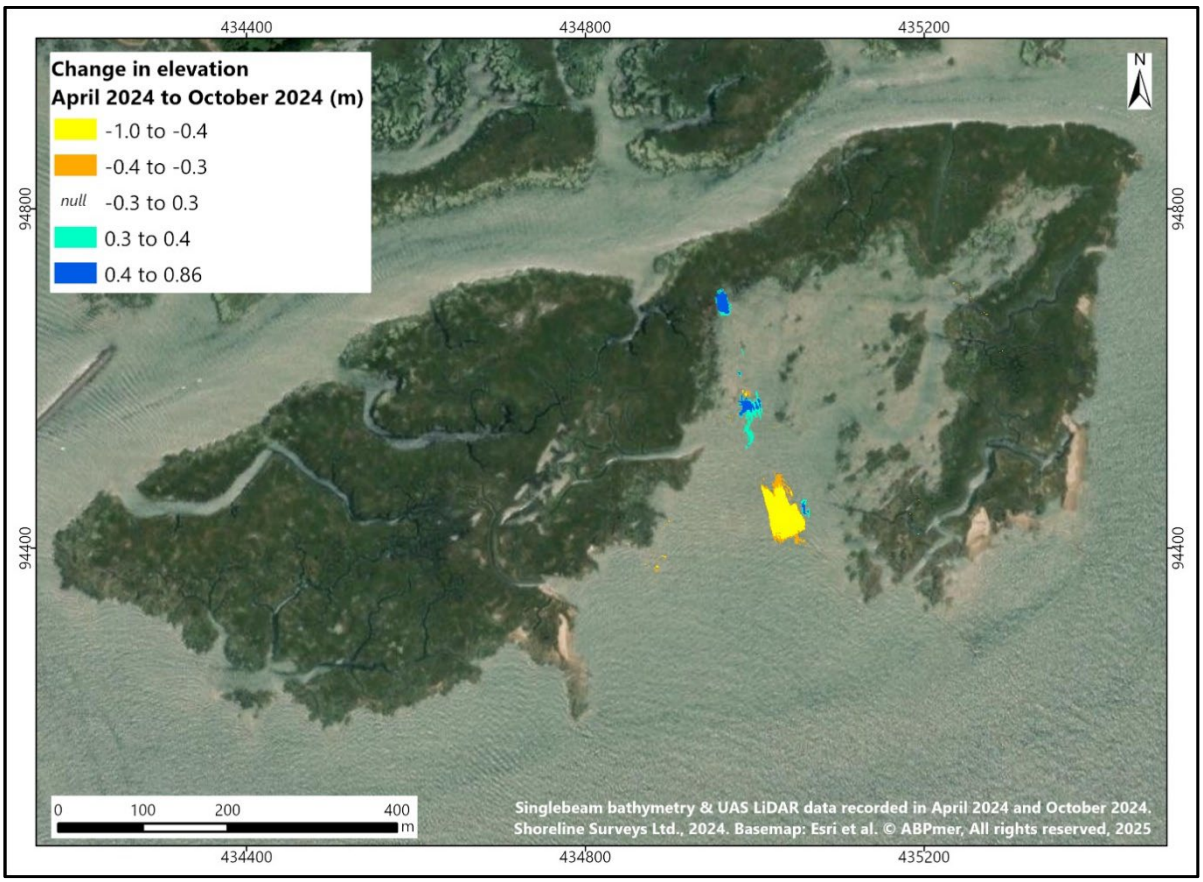


Figure 8. **Changes in bed elevation across restoration site between April and October 2024**

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Image 6. **Aerial view of whole restoration area from west**

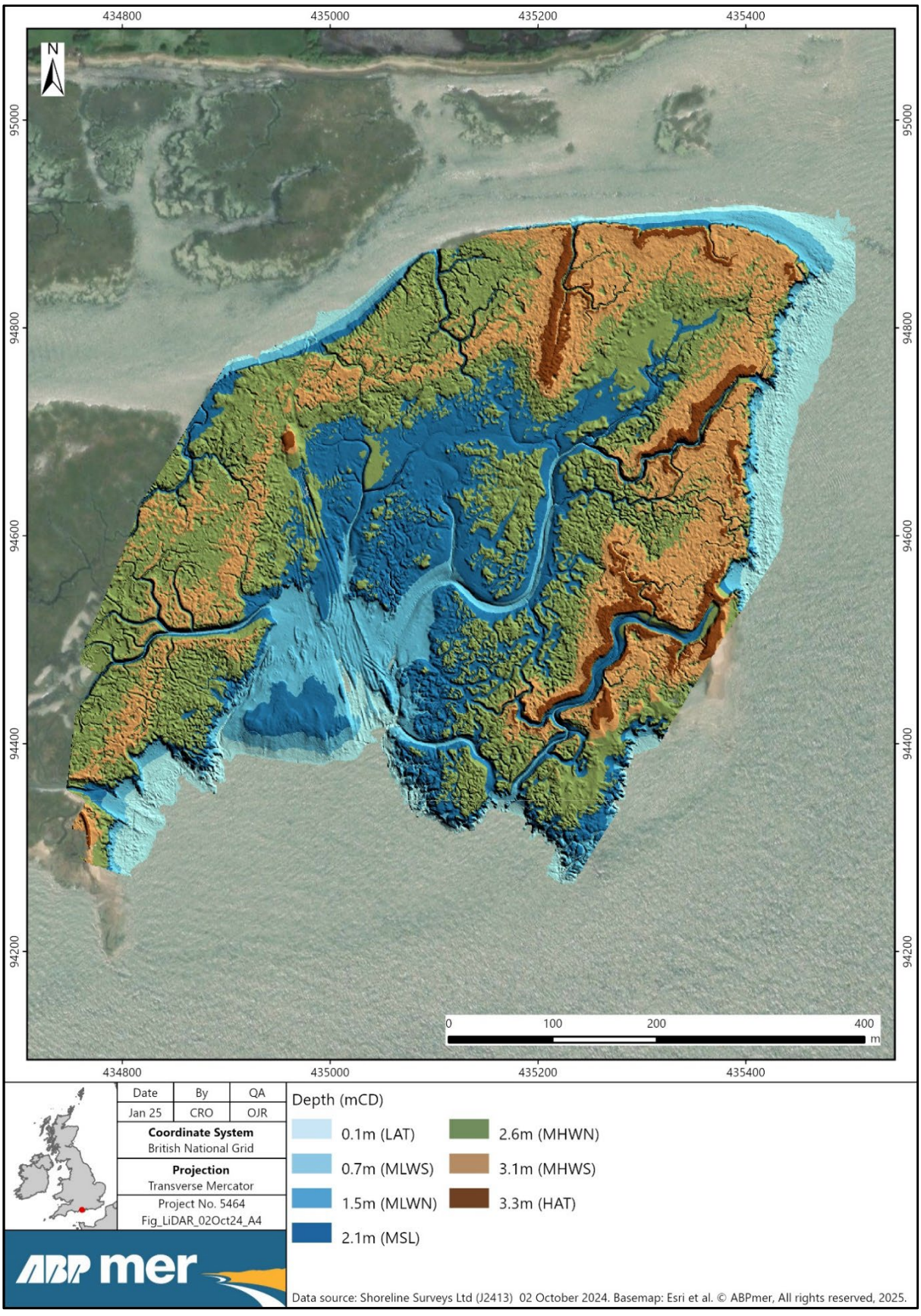


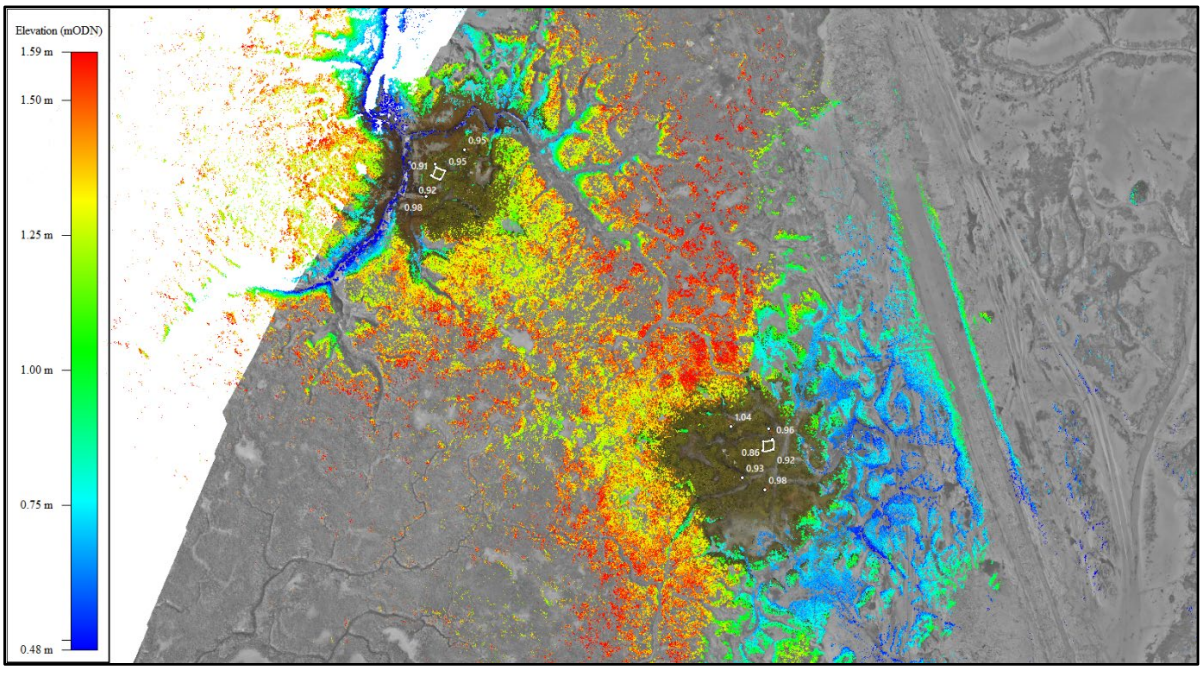
Figure 9. Topography map showing intervention areas during 2024 trial

The lessons learned from this work have been discussed (see Section 2.5) and will be taken forward into the next campaigns including work that is proposed for 2025, subject to funding being achieved. Future campaigns will benefit from the following:

- Having longer working windows to mitigate risk (including the effects of uncontrollable adverse weather conditions) and maximise the efficiency and productivity of the operations;
- Good quality data and information on the power, floatation and ground pressure requirements for amphibious excavators to successfully operate at Boiler Marsh
- Moving sediment over much shorter distances to maximise how much sediment is moved and how easy it is to be moved; and
- Introducing design modifications to the winch and cables that are used to pull the drag box across intertidal areas;
- Using a mix of techniques including for example, amphibius excavators, a concrete high-viscosity pump or cutter suction dredger to tailor the methods for each restoration area; and
- Allowing for moved sediment to be reprofiled once it has stabilised (in winter after a summer campaign) to enhance its height, shape and value for breeding birds and plant colonisation.

With these options in mind, LHC and ABPmer have started discussions with the MMO to see whether these can be accommodated within the existing marine licence. The need for changes in approach is recognised within Condition 5.2.4 of this licence which allows for an ongoing review and amendment of the approach through the submission of an updated method statement.

Finally, to provide some extra contextual information for this review and especially about the bed elevation across the survey site, Image 7 shows the outputs from the GeoSLAM LiDAR recording. Also, Figure 10 shows the extent of Boiler Marsh from Environment Agency 2022 LiDAR survey.



Source ABPmer (September 2024)

Image 7. GeoSLAM 3D LiDAR topography and photogrammetry at Sites Q2 and Q3

The GeoSLAM measurements were taken at Quadrat Sites Q2 and Q3 (see next section) to test this technique in this habitat. These measurements were useful for describing bed elevations at these sites in a new way and were used to verify other elevation readings for this study.

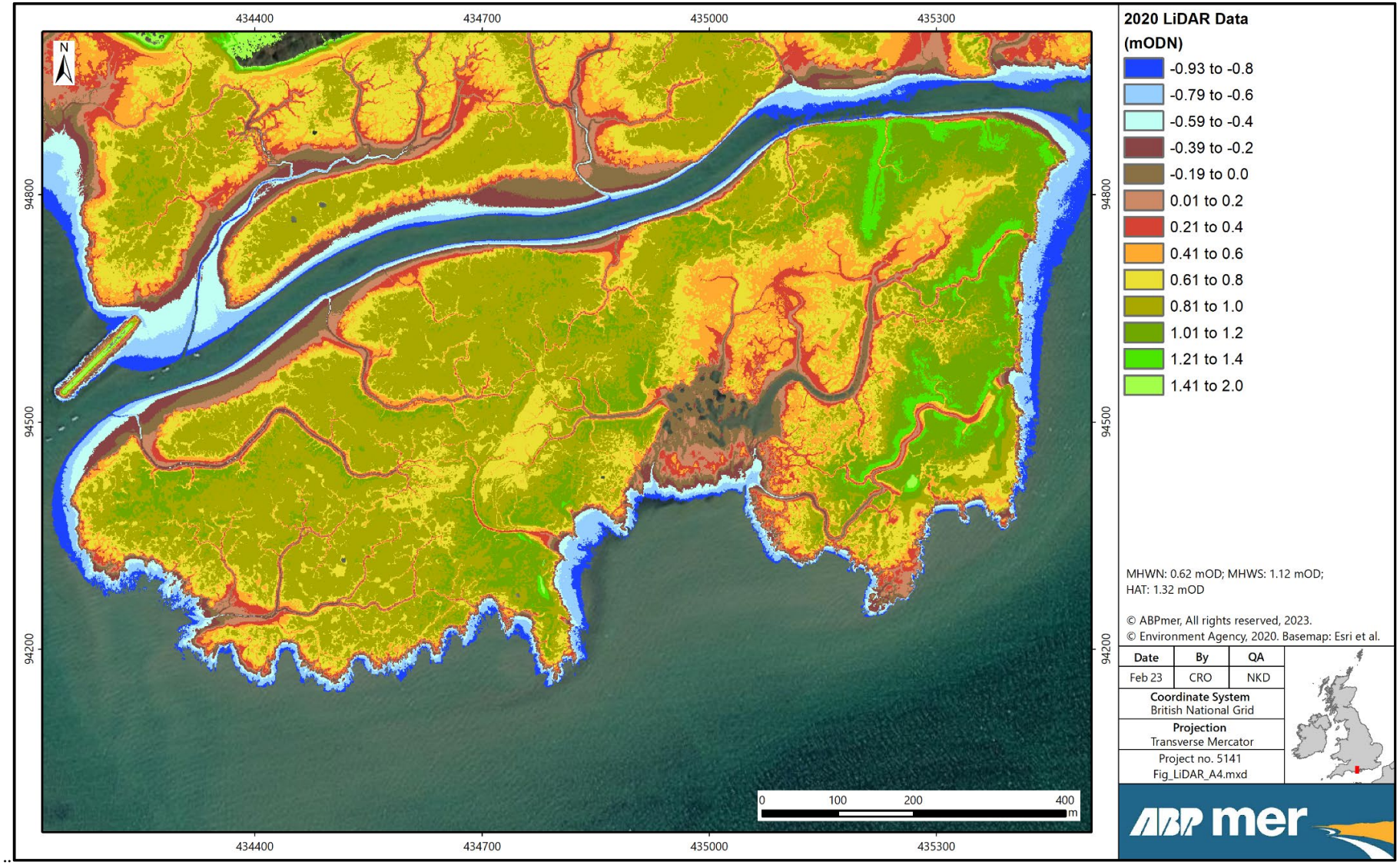


Figure 10. **Bed elevation across Boiler Marsh using Environment Agency 2020 LiDAR data**

In future these localised readings may be useful for evaluating change. However, while the data had a small purpose here, and was visually interesting, this is not an approach which now needs to be adopted regularly in the future across this terrain. The best and most comprehensive information is still provided by using the Environment Agency LiDAR data (see Figure 10) and the project-specific bathymetry and UAV topography surveys. These techniques should continue to be a main element of the monitoring programme.

3.3 Saltmarsh vegetation

The results of the September 2024 saltmarsh survey are shown in Table 1. This shows the plant coverage at each of the six sites at which a 4 m^2 quadrat was analysed (see also Image 8 and Image 9 as examples of the vegetation cover at two quadrat sampling). To allow a comparison to be made with the 'baseline' survey that was undertaken in July 2022, to underpin the MMO marine licence application (ABPmer, 2023), the equivalent results that surveys and the same site locations are shown in Table 2.

Table 1. Saltmarsh plant percentage cover at 4 m^2 quadrat sample site (9 Sept 2024)

Species / Quadrat	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Sea Purslane (*Atriplex portulacoides*)	N/S[4]			30		5	20
Sea Lavender (*Limonium vulgare*)		15	15	5	p		20
Sea Aster (*Aster tripolium*)			p				p
Saltmarsh-grass (*Puccinellia maritima*)			5			2	10
Glasswort/Samphire (*Salicornia* spp)		5	60	20	80		20
Common Cord-grass (*Spartina anglica*)		40					10
Sea-blite (*Suaeda maritima*)						8	10
Macroalgal cover		p			5		
Unvegetated exposed sediment		40	20	2	15	2	0

Table 2. Saltmarsh plant percentage cover at 4 m^2 quadrat sample site (27 July 2022)

Species / Quadrat	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Sea Purslane (*Atriplex portulacoides*)				50		95	30
Sea Lavender (*Limonium vulgare*)	40	25	20	8			40
Saltmarsh-grass (*Puccinellia maritima*)							10
Glasswort/Samphire (*Salicornia* spp)	7	10	50	20	P		10
Common Cord-grass (*Spartina anglica*)	1	55	5	20	80	5	10
Sea-blite (*Suaeda maritima*)			P				
Macroalgal cover	2	P					
Unvegetated exposed sediment	50	10	25	2	20	0	0

To further illustrate the baseline conditions across these sites and the areas surrounding them, Figure 5 reproduces a plot from ABPmer (2023) review. This figure shows the quadrat locations over a detailed aerial drone survey image taken that was also taken (by ABPmer for LHC) during summer 2022.

These results, and observations made during the survey, show that there has been no obvious change to these habitats, at most locations, between the July 2022 and September 2024 surveys. The one exception is at Site Q2 which lies on the very edge of the restoration area. At this site the extent of plant cover has noticeably declined over just the last two years. This site is in a relatively exposed

[4] This site was not surveyed during the 2024 campaign. There was not enough time to safely access this location.

situation and this change will reflect a process of ongoing internal marsh edge deterioration due to increasing tidal inundation, exposure and other physical and biological stresses.

Across the rest of the sites sampled, including the other marsh edge location (Site Q5), there was no notable change. For most of the sites though, no detectable change is expected over such a short time frame. That is because these sites are reference locations that are positioned away from the restoration zone across a range of different and safely accessible areas.

The data collected now from these reference sites will be increasingly useful later in the monitoring programme. It will be valuable for assessing how these sites evolve over longer time frames. Also, in the short term it will be valuable as reference information about plant compositions from different marsh types at different bed elevations. This means that future plant growth in the restoration area can later be compared against these as that area matures.

It is expected that the restoration area and the raised beds of introduced dredge sediment will mature and have increased plant cover over the next three to four years. The rates and nature of that cover will be dependent upon the bed levels achieved and the goal is to achieve as much coverage above the mean high water spring tide elevation (3.1 m CD or 1.1 m ODN) as is possible.

As the restoration work has only just begun, there has been no opportunity yet for plant growth on the area of sediment relocated during the 2024 campaign. This process of colonisation, especially of pioneer and annual samphire or sea-blite species, may well begin next spring and summer from seeds locally dispersed during the 2024 autumn months.

As noted above, it will be possible to use data from the reference sites (as shown in Table 1 and Table 2) as a context for describing how the restoration areas matures. This data describes a range of the lower to middle marsh plant assemblages that characterise the eastern half of Boiler Marsh.

In general, the areas of marsh with the densest plant assemblages are, as expected, on the highest and least frequently inundated ground. But, as is typical of marsh habitats, factors other than inundation have a role to play. These factors exposure, sediment stability and proximity to drainage channels. To illustrate the role of these factors, the characteristics and conditions of each quadrat site are summarised as follows:

- **Site Q2:** This is a relatively lower lying (at 0.92 m ODN) and exposed site that has shown signs of deterioration and decline in plant cover over just the two years between 2022 to 2004 (as described above);
- **Site Q3:** This site is at a similar low elevation to Q2 (at 0.94 m ODN), but it lies a more sheltered area and has shown no clear change between surveys. During both 2022 and 2024 it was dominated by annual growths of samphire (50-60% cover) with some sea lavender also present;
- **Site Q4**. This site is only around 13 cm higher than Q2 and Q3 (at 1.06 m ODN), this modest difference, and the site's position away from exposed marsh edges and close to a channel for drainage, leads to dense cover of sea purslane and annual samphire in both 2022 and 2024;
- **Site Q5**: This site at the northern margins of the restoration area has the lowest elevation (at 0.73 m ODN[5]). In both 2022 and 2024 it had dense *Spartina* cover and main change between surveys was the presence of fucoid algae in 2024 which could presage a change occurring;

[5] This is 0.11 m (11 cm) above the Mean High Water Neap (MHWN) elevations (0.62 m ODN or 2.6 m CD).

- **Site Q6**: This is the highest lying site (at 1.24 m ODN[6]) and because it lies next to a channel it is well drained and characterised by sea purslane[7]. This habitat is ideally suited for nesting waterbirds, and one of last season's nests lies at the edge of the quadrat (see Image 9);
- **Site Q7**. This site has the greatest range of species (seven recorded in 2024 and, like Q6, a dense 100% coverage of plants. It is similar in elevation to Q4 (at 1.05 m ODN) which again shows the value of even modest increase in bed elevation relative the exposed marsh fringes.

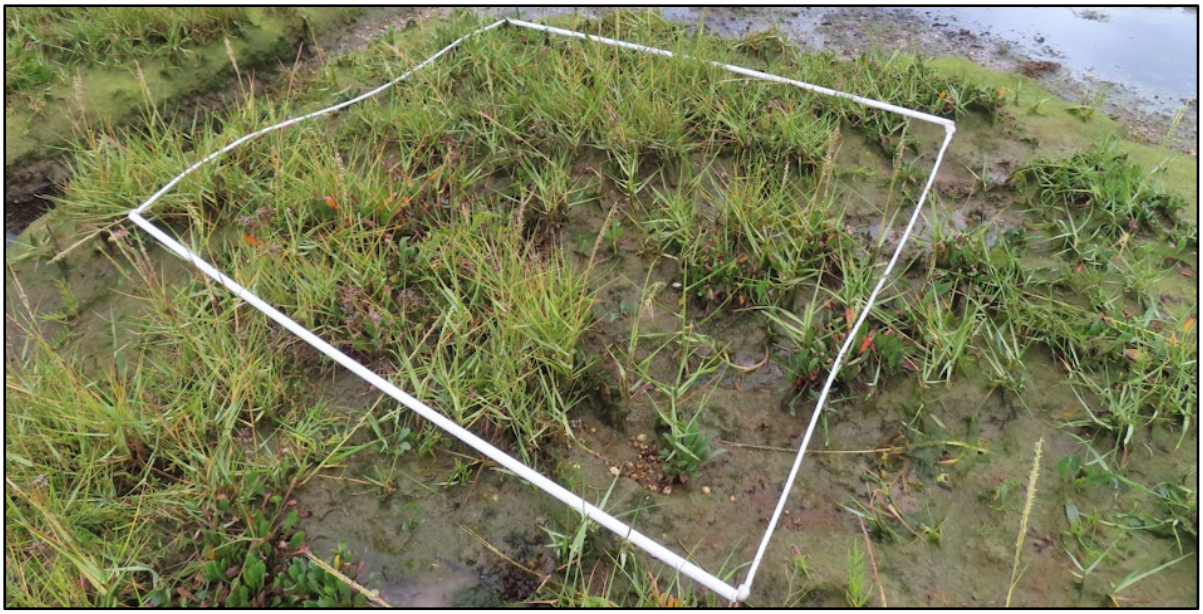


Image 8. Deteriorating internal marsh edge with mainly Spartina at Site Q2

Image 9. Sea purslane dominated marsh at Site Q6

[6] This is 0.14 m (14 cm) above Mean High Water Spring (MHWS) elevation (which is 1.1 m ODN or 3.1 m CD).

[7] Sea purslane does not have root aerenchyma (tissue that allows saltmarsh plants to cope with low soil oxygen levels by moving oxygen down to their roots) and therefore favours areas with sediment that is well drained and aerated

As detailed above, these descriptions can be used to interpret how the restoration area develops over time based on the bed elevations attained and other factors. They show that the lowest levels at which vegetation occurs is 0.7 to 0.9 (depending on the level of site exposure) as illustrated by the quadrat locations described above. Even the lowest marshes edges (0.73 m ODN at Q5) is around 0.11 m (11 cm) above the MHWN elevation (which is at 0.62 ODN or 2.6 mCD). The main, and currently unvegetated, restoration area is around and below this elevation around 0.4 to 0.8 m ODN (2.4 to 2.8 m CD).

This illustrates how small changes in elevation and exposure have distinctive ecological effects in the flat landscapes of saltmarsh habitats. It also emphasises the risks of sudden ecological shift posed by continuing sea level rise to such habitats. The goal for the sediment recharge projects and future campaigns on Boiler Marsh should be to achieve at least these modest bed elevation changes but, more than that, to try and place the sediment at as high an elevation as is possible (especially above MHWS) to benefit plants and breeding birds

The results of this saltmarsh survey, and the previous one in 2002, can now be used as the basis for interpreting the effectiveness of these future campaigns. This includes examining, in 2025, the physical and ecological changes to the sediment that was moved during the 2024 campaign.

4 Summary and Next Steps

The report reviews the survey work undertaken to accompany the first stage of the new 10-year Boiler Marsh habitat restoration project. This project and the monitoring programme are being implemented under Marine Licence L/2023/00294/1 and this report has been produced (as required in fulfilment of Conditions 5.2.19 and 5.2.20 of the licence) to understand whether this first trial was successful.

This first trial was undertaken during September 2024. For this campaign, the amount of sediment moved from the established deposit ground to the higher intertidal areas, for marsh restoration, was a lot lower than planned. That is because many technical challenges and issues were encountered that are listed in Section 3.2.

On completion of the work, two raised mounds of sediment were created. The northernmost of these was especially high in elevation and this one is most likely, depending on how it settles, to be suitable for marsh plant growth. It may even support nesting seabirds (in very small numbers if at all given its size) next spring and summer. However, the ecological value of these 'recharged' areas is still to be determined and will depend upon how they adjust and evolve during the winter months.

Notwithstanding that a relatively small amount of sediment was used to 'recharge' the relict marsh habitat, many lessons were learned from this work about the practicalities of moving sediment as well as about the contractual and regulatory processes needed to enact such an innovative measure. This first trial was pursued to explore new ways of beneficially using dredge sediment and push at the boundaries of how we think about, and use, this material. It has done that; but it has also demonstrated how multiple issues and challenges can be encountered when adopting a novel approach.

It was also central to the long-term project that new lessons are learned which can now be taken into the next phases of work. A major lesson from the first trial was that the distances over which the sediment was moved were too great and the terrain too difficult to work efficiency within. This meant that too much strain was placed on the winch and the drag box. There were also other issues including bad weather conditions, a too confined working window and equipment difficulties.

The next phase is scheduled for late summer/autumn this year, 2025, subject to confirmation of funding. For this second campaign it is proposed that the dredge sediment will be moved over shorter distances.

LHC and ABPmer have started discussions with the MMO to ensure this approach can be accommodated within the existing marine licence which allows for an ongoing review of the approach and the monitoring needs. LHC and ABPmer have also submitted a marine licence variation request (MLA2023/00052/2 to make the changes referred to in Section 3.2 to enhance the outcomes of future projects.

The survey work will also continue during 2025 in accordance with the monitoring plan requirements (ABPmer, 2024a). This will accommodate further lessons of the 2024 campaign one year on which will then be reported at the end of this calendar year.

5 References

ABPmer, (2023). Beneficial Use of Dredged Sediment to Improve Boiler Marsh, Lymington, Disposal site characterisation assessment to inform new saltmarsh restoration project in Lymington Estuary, ABPmer Report No. R.3969. A report produced by ABPmer for Lymington Harbour Commissioners, February 2023.

ABPmer, (2024a). Boiler Marsh Restoration: Monitoring Plan, Review of monitoring to assess project outcomes and fulfil Condition 5.2.19 of MMO Marine Licence L/023/00294/1, ABPmer Report No. R.4545, for Lymington Harbour Commissioners, May 2024.

ABPmer, (2024b). Beneficial Use of Dredged Sediment to Improve Boiler Marsh, Lymington, Photographic record of habitat before 2024 campaign in fulfilment of Condition 5.2.5 in Marine Licence L/2023/00294/1, ABPmer Report No. R.4599. A report produced by ABPmer for Lymington Harbour Commissioners, August 2024.

ABPmer, (2024c). Beneficial Use of Dredged Sediment to Improve Boiler Marsh, Lymington, Photographic record of habitat after 2024 campaign in fulfilment of Condition 5.2.22 in Marine Licence L/2023/00294/1, ABPmer Report No. R.4654. A report produced by ABPmer for Lymington Harbour Commissioners, October 2024.

ABPmer, (2025). Solent State of Nature Report, Volume 1 – main report. ABPmer Report No. R.4618. A report produced by ABPmer for Blue Marine Foundation, January 2025.

ABPmer OMReg Database – West Itchenor: https://www.omreg.net/query-database/0033-west-itchenor/

HCC (2024). Breeding Seabird Report 2024 for the Western Solent. Hampshire County Council

6 Abbreviations/Acronyms

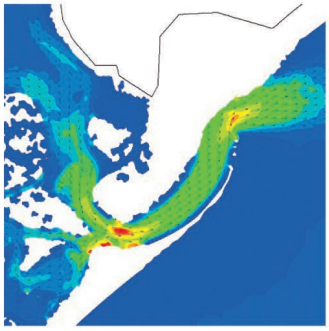
3D	Three-Dimension(al)
CD	Chart Datum
CEH	Centre for Ecology and Hydrology
DJI	DJI Technology Ltd manufactures commercial UAVs
GeoSLAM	GeoSLAM Ltd
GPS	Global Positioning System
ha	Hectare(s)
HAT	Highest Astronomical Tide
HCC	Hampshire County Council
HIWWT	Hampshire and Isle of Wight Wildlife Trust
LAT	Lowest Astronomical Tide
LAWS	Land and Water Services Ltd
LHC	Lymington Harbour Commissioners
LiDAR	Light Detection and Ranging
MHWN	Mean High Water Neaps
MHWS	Mean High Water Springs
MLWN	Mean Low Water Neaps
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MSL	Mean Sea Level
N/S	Not Surveyed
NE	Natural England
ODN	Ordnance Datum Newlyn
OMReg	Online Marine Registry (ABPmer)
Q	Quadrat
RTK	Real Time Kinematics
SRDB	Saltmarsh Restoration Drag Box
UAV	Unmanned Aerial Vehicle

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

Appendix




Innovative Thinking - Sustainable Solutions

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A Boiler Marsh Topographic Maps

This appendix includes two detailed bed elevation maps of the Boiler Marsh restoration area and dredge sediment placement zone. These maps were produced by Shoreline Surveys Ltd following surveys they conducted (on behalf of LHC and LAWS) before the restoration work on 25 April 24 and then immediately after it on 02 October 2024.

These two maps (Map 1 and Map 2) were created by combining data from boat-based bathymetric and UAV-derived topographic surveys on each occasion. The areas covered by these surveys are illustrated in Figure 6 within the covering report and Figure 7 of the report illustrates the main bed elevation changes between them.

SHORELINE SURVEYS LTD

Hydrographic — Geophysical — Topographic

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Telephone: +44 7950 038317
email@shorelinesurveys.com – www.shorelinesurveys.com

TITLE:

Single Beam & UAS LiDAR Bathymetric Survey of the Boiler Marsh Deposition Area

CLIENT: Lymington Harbour Commissioners

PROJECT: Post–dredge survey

Project No: J2329	Scale:	Date:	Surveyed by: TG,JW
Drawing No: 01	1:1250	25.04.24	Drawn by: WA
			Checked by: TG

NOTES/REVISIONS:

Contours are only indicative of bed topography and should be treated as such.

Shore data is approximate and should be treated as such.

DO NOT SCALE

BATHYMETRIC SURVEY

Coordinated in OSGB36 using OSTN15.

Depths below Chart Datum (CD) in metres.

CD taken as 1.98 metres below Ordnance Datum Newlyn (ODN).

Tidal data recorded by RTK GNSS.

Soundings sorted at 7.5 metre intervals using IHO rounding rules.

Contours at 0.25 metre intervals.

Single beam line spacing: 40 metres.

Bed mounted obstructions are not certainly detected.

- Survey extents
- Single Beam coverage
- UAS LiDAR coverage
- Withy Posts

Depth Colour Key:

<-3.25

>= 1.50

SCALE

250 Metres

50 M

435000 E

435200 E

435400 E

434800 E

94800 N

94600 N

94400 N

94200 N

94000 N

W1

W3

W5

SHORELINE SURVEYS LTD

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TITLE:

Single Beam & UAS LiDAR Bathymetric Survey of the Boiler Marsh Deposition Area

CLIENT: Lymington Harbour Commissioners

PROJECT: Monitoring Survey

Project No: J2413	Scale:	Date:	Surveyed by: SHB,EF
Drawing No: 01	1:1250	02.10.24	Drawn by: TG
			Checked by: EF

NOTES/REVISIONS:

Contours are only indicative of bed topography and should be treated as such.

Shore data is approximate and should be treated as such.

- Survey extents
- Single Beam coverage
- UAS LiDAR coverage
- Volume boundaries
- LAWS full restoration area
- LAWS Phase1 restoration area

BATHYMETRIC SURVEY

Coordinated in OSGB36 using OSTN15.

Depths below Chart Datum (CD) in metres.

CD taken as 1.98 metres below Ordnance Datum Newlyn (ODN).

Tidal data recorded by RTK GNSS.

Soundings sorted at 7.5 metre intervals using IHO rounding rules.

Contours at 0.25 metre intervals.

Single beam line spacing: 40 metres.

Bed mounted obstructions are not certainly detected.

SINGLE BEAM SURVEY

Single beam echosounder: Norbit iWMBS.

Positioning: Norbit iWMBS and Applanix Wavemaster II.

Operational frequency: 400 kHz

RTK GNSS, tidal and IMU data post-processed using PosPAC MMS.

UNMANNED AERIAL SYSTEM LIDAR SURVEY

LiDAR: DJI Zenmuse L1.

Aerial platform: DJI Matrice 300 RTK

Scan rate: 180,000 pts/s ¦ Return mode: Dual.

RTK GNSS and IMU data post-processed using DJI Terra.

Depth Colour Key:

<-3.25

>= 1.50

SCALE

250 Metres

50 M

435000 E

435200 E

435400 E

434800 E

94800 N

94600 N

94400 N

94200 N

94000 N

A1

A2

A3

A4

A5

A6

A7

A8

A9

A10

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