

CARDIGAN TIDAL FLOOD RISK MANAGEMENT SCHEME

Appendix 6.3 – Afon Teifi Saltmarsh – Niche Assessment



Cyfoeth Naturiol Cymru
Natural Resources Wales



binnies
Enhancing lives, communities
and the environment

Afon Teifi Saltmarsh – niche Assessment

Richard Park

Coastal Adaptation Programme Lead (National Habitat Creation Manager)

03/06/2025 v2

EXECUTIVE SUMMARY

In conclusion the Cardigan flood risk management embankment under design consideration can now base its seaward embankment elevation and gradient on local evidence of saltmarsh distribution extent and benthic gradient characteristics. The evidence from this assessment indicated that the gradient of the flood risk embankment will not likely impact the success of subsequent saltmarsh colonisation directly as saltmarsh in the local area exhibits a wide range of benthic gradients. However, it is logical to ensure that the design gradient does not inhibit sedimentation and accretion by being too steep! The embankment slope can therefore be as little as 0.02 % (very flat) or as steep as 49.5% based on local evidence.

In respect to the elevation of the seaward embankment at the toe of the vertical defence wall, an elevation of approximately 3mAOD is advised in order to avoid limiting the development of saltmarsh to its natural (locally) recorded maximum extent although this is of course likely to be exceeded naturally by subsequent sediment accretion over time which will deposit muds on the surface of the embankment. An alternative pragmatic design could consider an elevation reflecting the mean upper limit of no less than 2.5mAOD. However, it is preferable to design the upper embankment level above this as it would provide some resilience to climate change related sea level rise by allowing the saltmarsh to migrate a short distance before being squeezed by the vertical piling.

Optimising the design to facilitate saltmarsh development to its full (current) natural distribution while facilitating natural accretion is therefore the preferred design option, Needless to say that this can be assessed as part of the balance of habitat losses and gains within the project assessment. Additionally, the optimisation of design to facilitate saltmarsh habitat creation could potentially be considered as a “programme and measure” under the Water Framework Directive (WFD) in respect to a mitigation and offset for hydromorphological pressures within the heavily modified water body if these are shown to be appropriate. This should be a consideration within the assessment.

The assessment

A total of 29 transects from a number of areas of saltmarsh were assessed for their intertidal gradient. Additionally, two zones within the Wildlife Reserve were assessed for their upper natural saltmarsh distribution measured as elevation “above ordnance datum” or (AODm). This is the national height system used in the UK relative to fixed reference point, the Newlyn Ordnance Datum, based on mean sea level in Cornwall. These evidence (gradient and elevation extent) will highlight the natural local niche in respect to the combined marine (tidal) and riverine fluvial influences on the saltmarsh habitats in the Afon Tyfi. Any subsequent elevation (shown here as AODm Newlyn) can be related to tidal levels and river flow (Q) scenarios.

The main caveat of the assessment is that it is current and does not project the niche saltmarsh extent into the future in respect to sea level rise likely to impact the Afon Tyfi over the residual life (c.100 yrs) of the proposed FRM assets under consideration. If these are to be integrated into the assessment it is recommended that the UKCP18 projections relating to RCP8.5 95%ile be used; projecting the current extent based on future MHWS scenario in the Afon Tyfi.

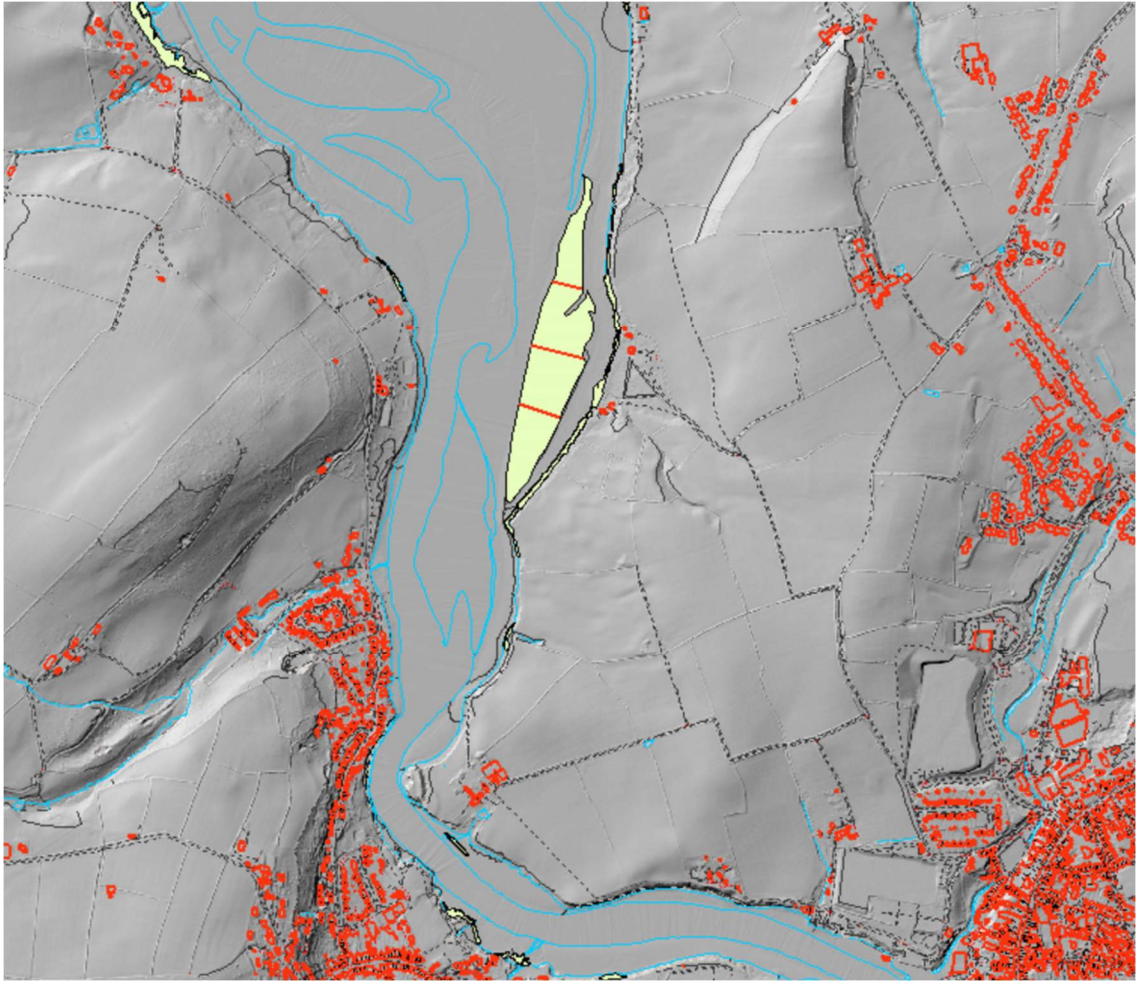
Saltmarsh Gradient Analysis

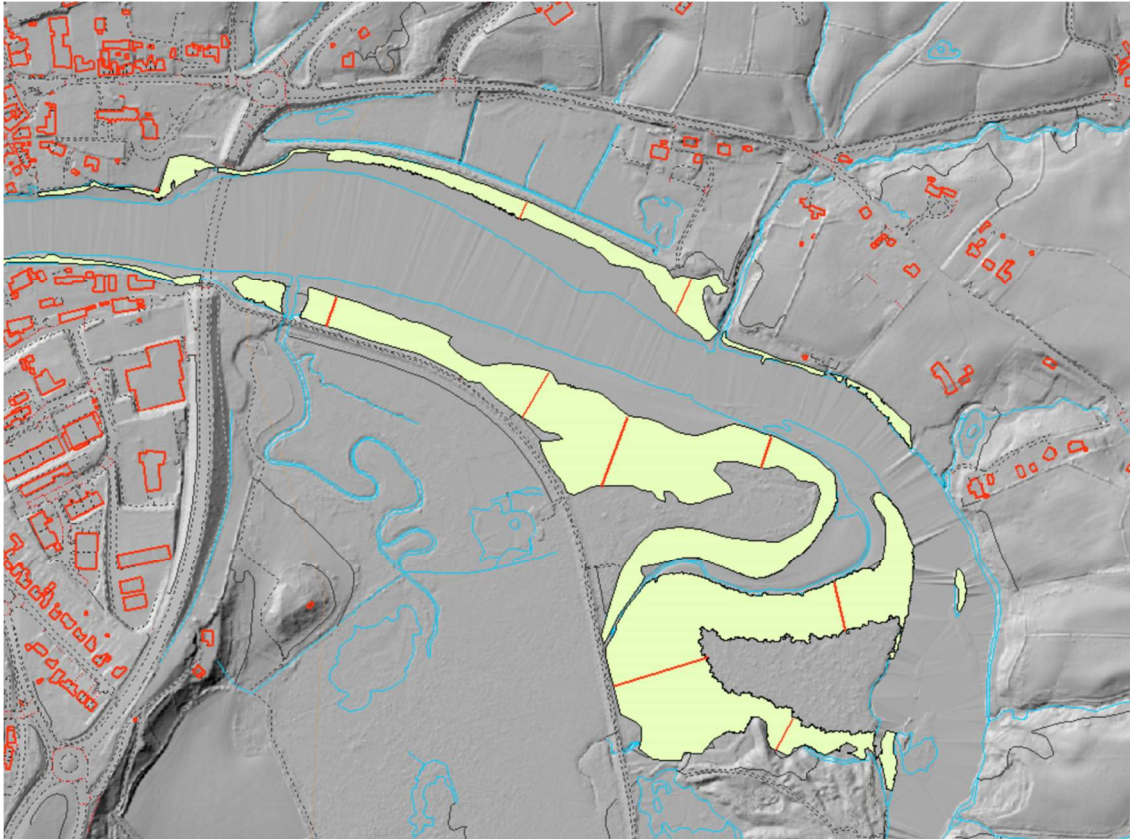
Summary: Saltmarsh in the Afon Teifi appears to be tolerant and un-constrained by the gradient with saltmarsh distribution occurring in very flat areas (minimum gradient of 0.02%) over a range of slope to steep zones of sediment (45.51%). See below for specific gradients relating to the areas up-stream, within and down-stream of the project area:

These two figures illustrate the areas of saltmarsh (light green) and the transects used in the evaluation of gradient (red lines). A linear regression was undertaken on the profile elevation using the latest “all Wales Lidar digital terrain model) and the gradient calculated using the equation $y = mx + C$ (m = gradient). When the profile exhibits a range of distinct gradients, the transect data was divided into separate assessments of slope using discrete regression analysis. The saltmarsh distribution was determined by NRW using ground and aerial survey and is the most contemporary available (2025).

Saltmarsh Distribution Data Source:

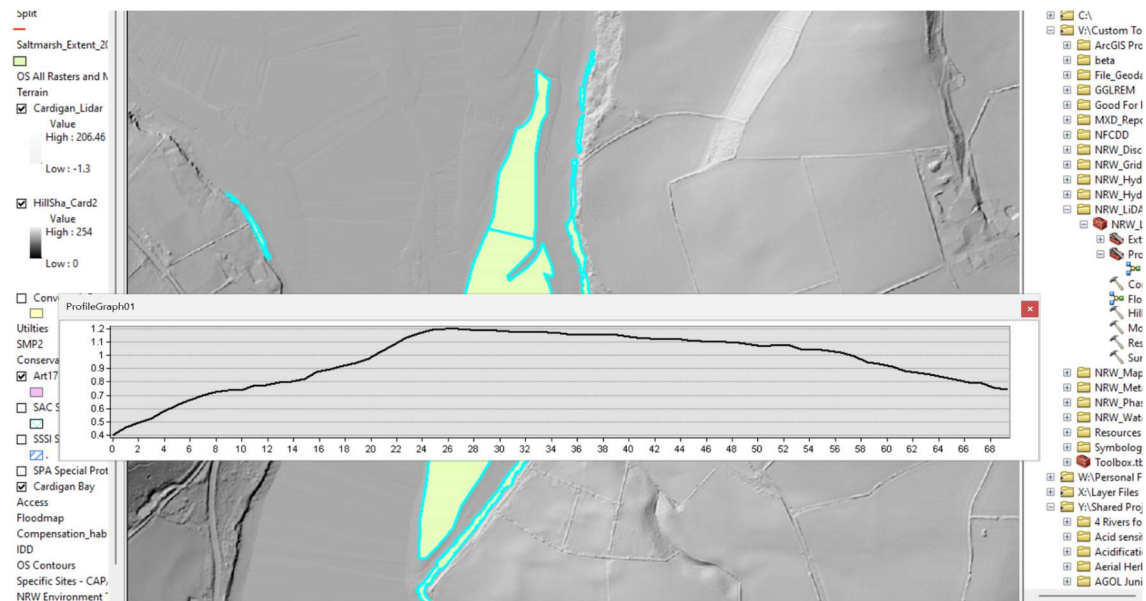
Y:\Knowledge_Strategy_Planning\Evidence_Knowledge_Advice\Evidence_Analysis\Coastal Habitats\Saltmarsh extent Maps 2025\Saltmarsh extent maps.gdb



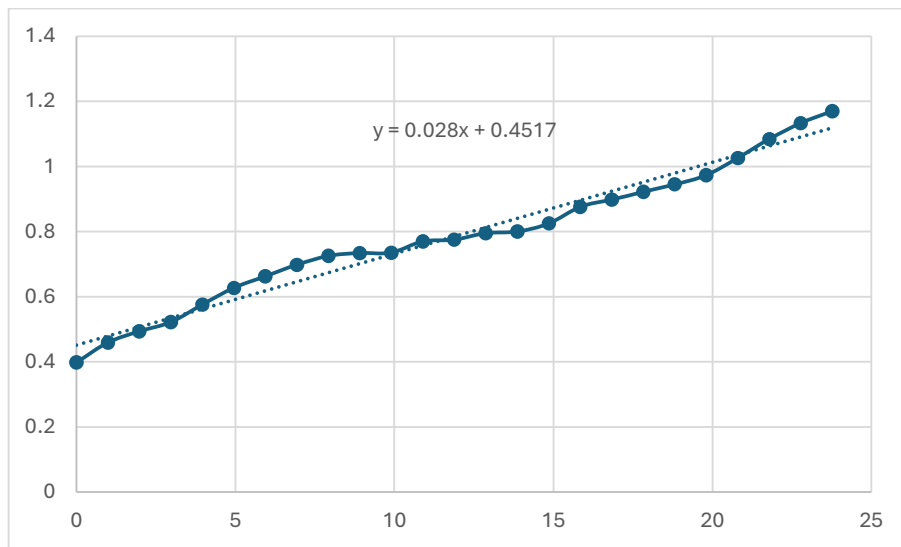


Gradient Analysis Details

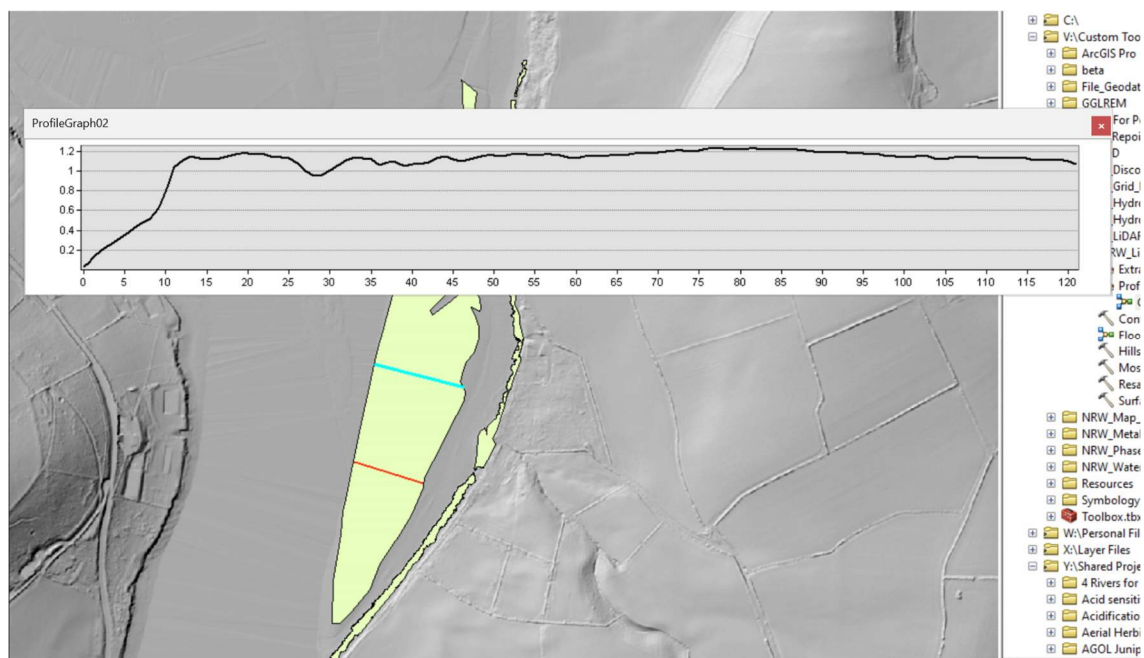
Gradient A



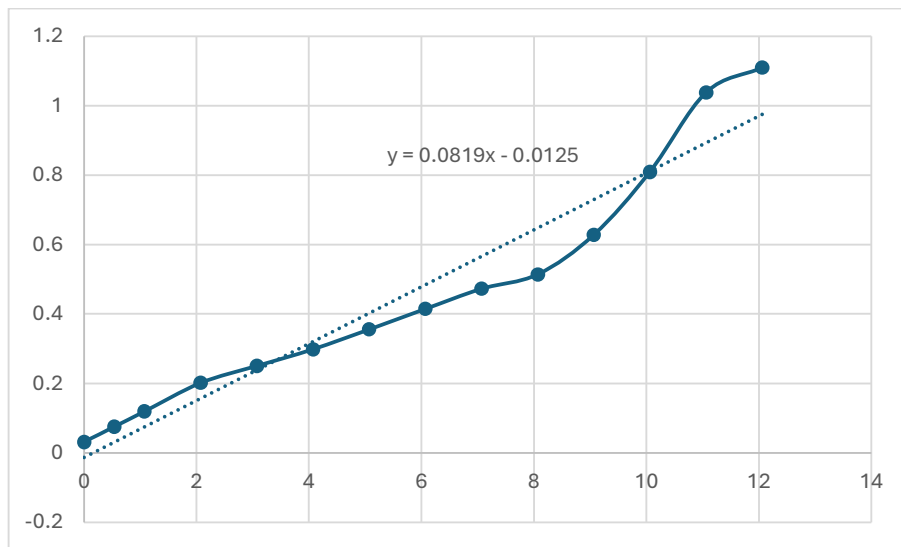
Related gradient for 0-24m seaward slope. Gradient = 0.028 (2.8%)



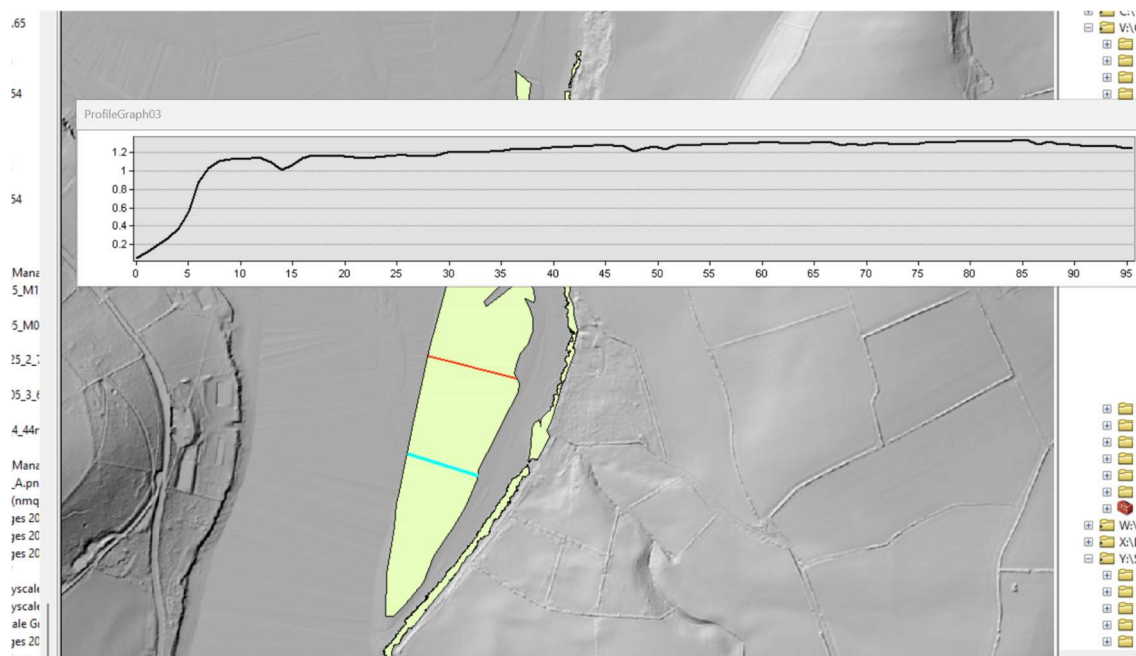
Gradient B



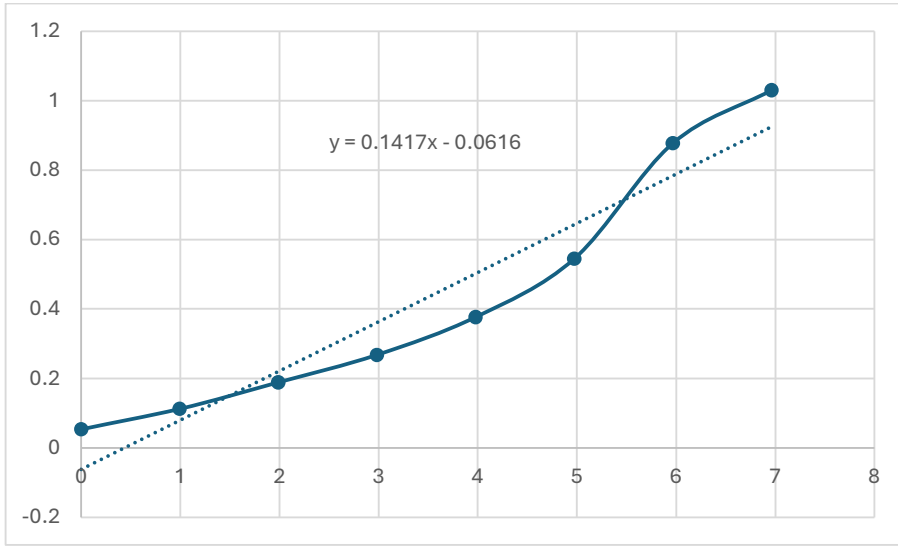
Related gradient for 0-12m seaward slope. Gradient = **0.0819 (8.19%)**



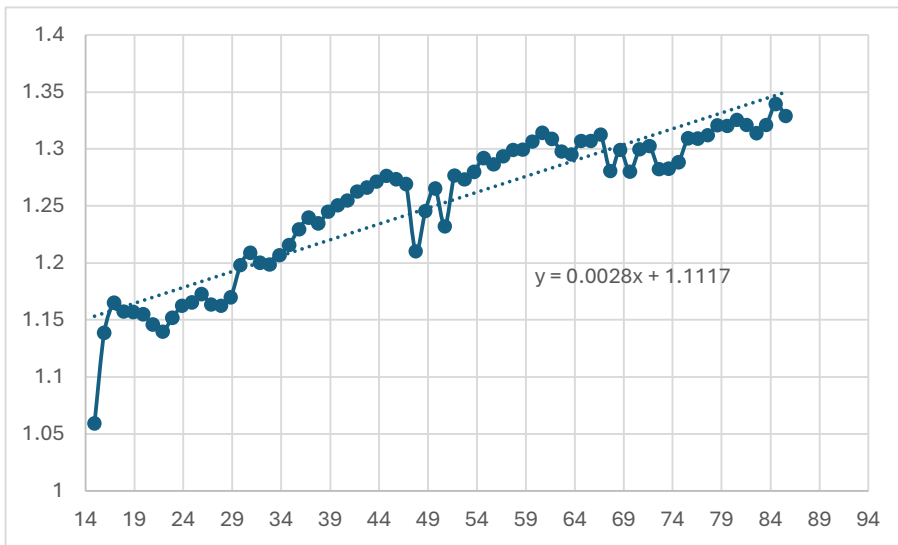
Gradient C



Related gradient for 0-7m seaward slope. Gradient = 0.1417 (14.17%)



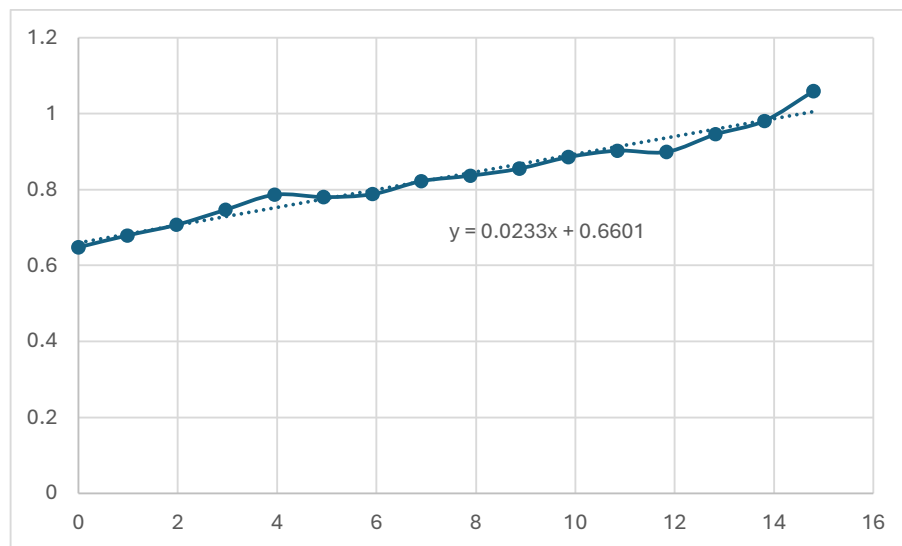
Related gradient for 15-85m seaward slope. Gradient = **0.0028 (0.28%)**



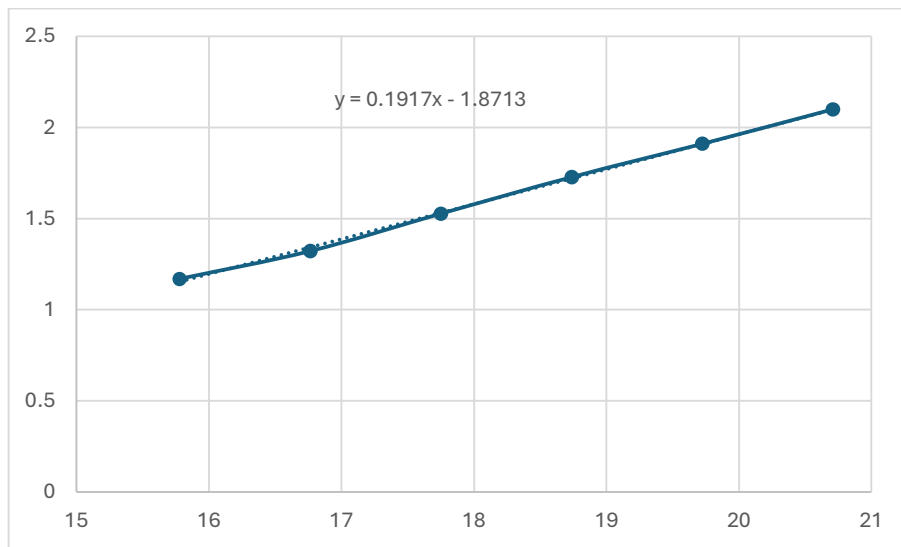
Gradient D



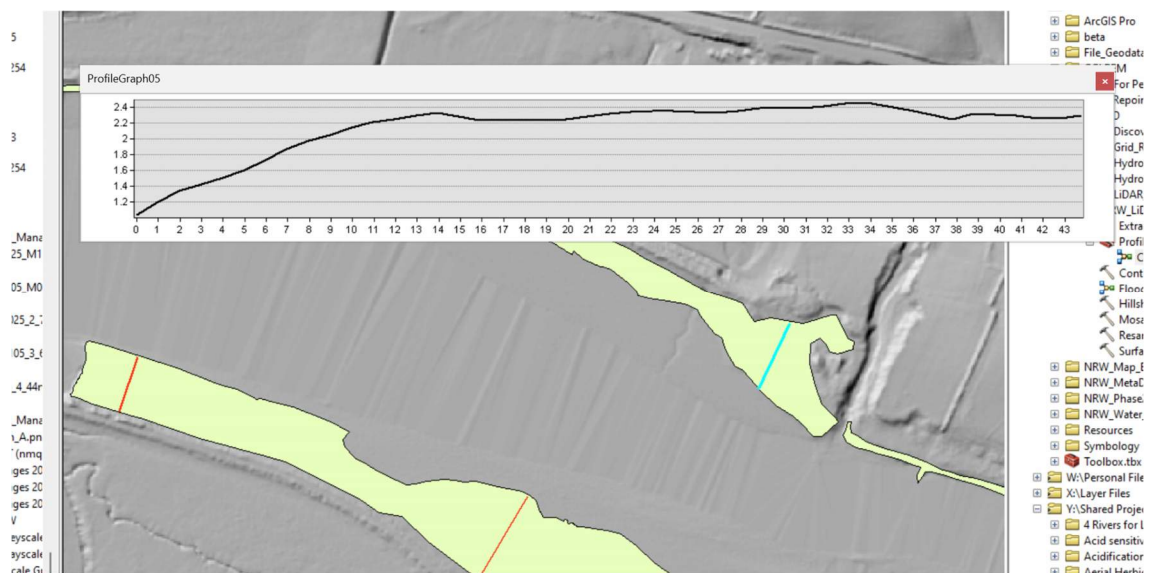
Related gradient for 0-15m seaward slope. Gradient = 0.0233 (2.33%)

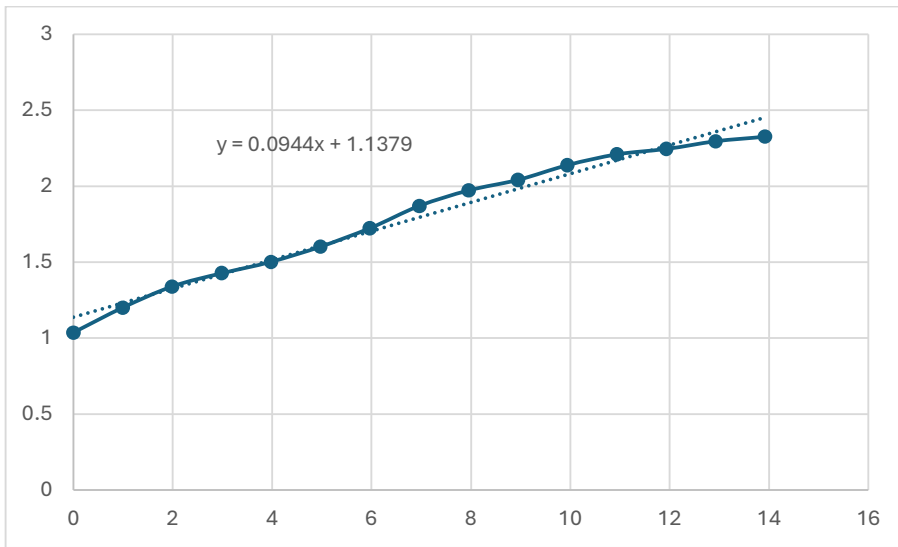


Related gradient for 15-21m seaward slope. Gradient = 0.1917 (19.17%)

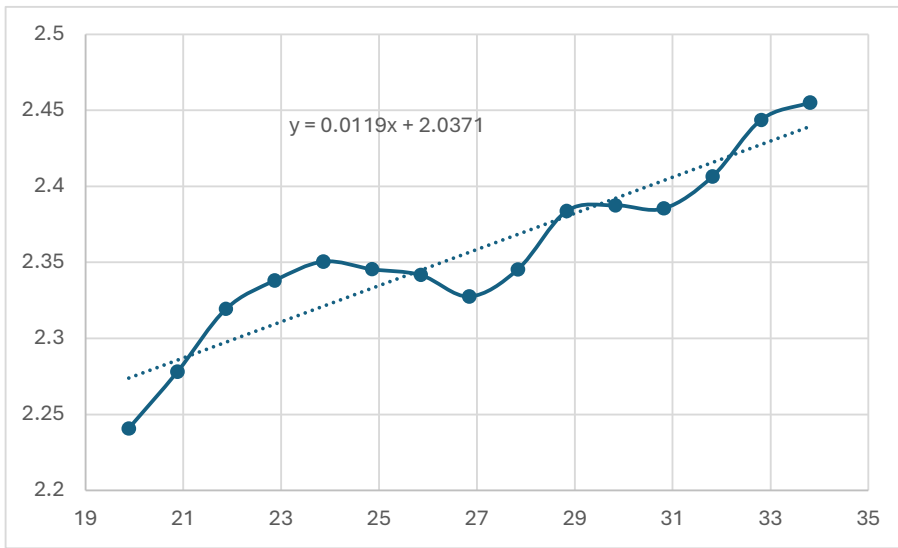


Gradient E

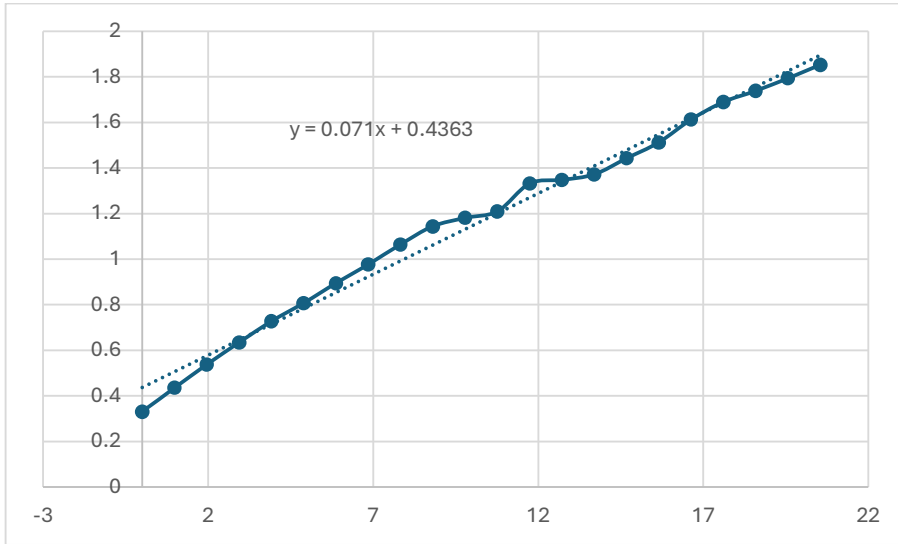




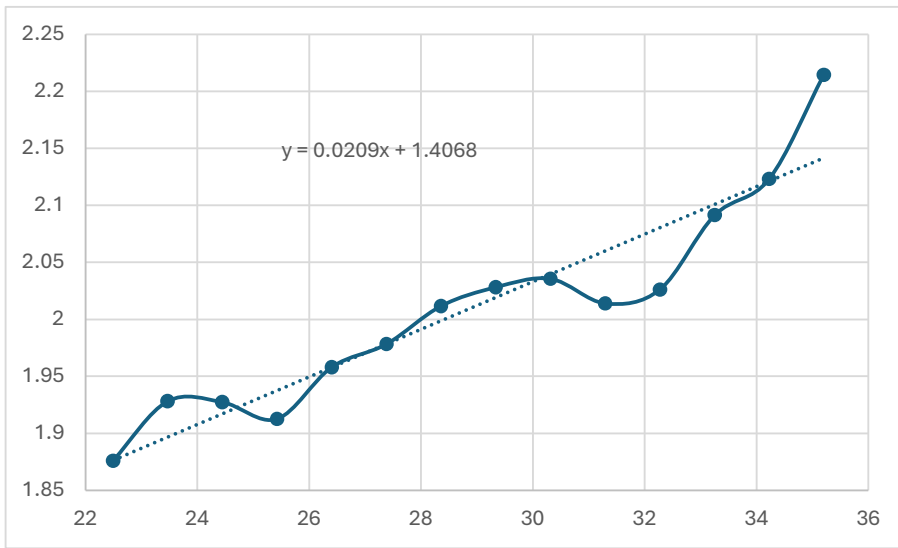
Related gradient for 20-34m seaward slope. Gradient = **0.0119 (1.19%)**



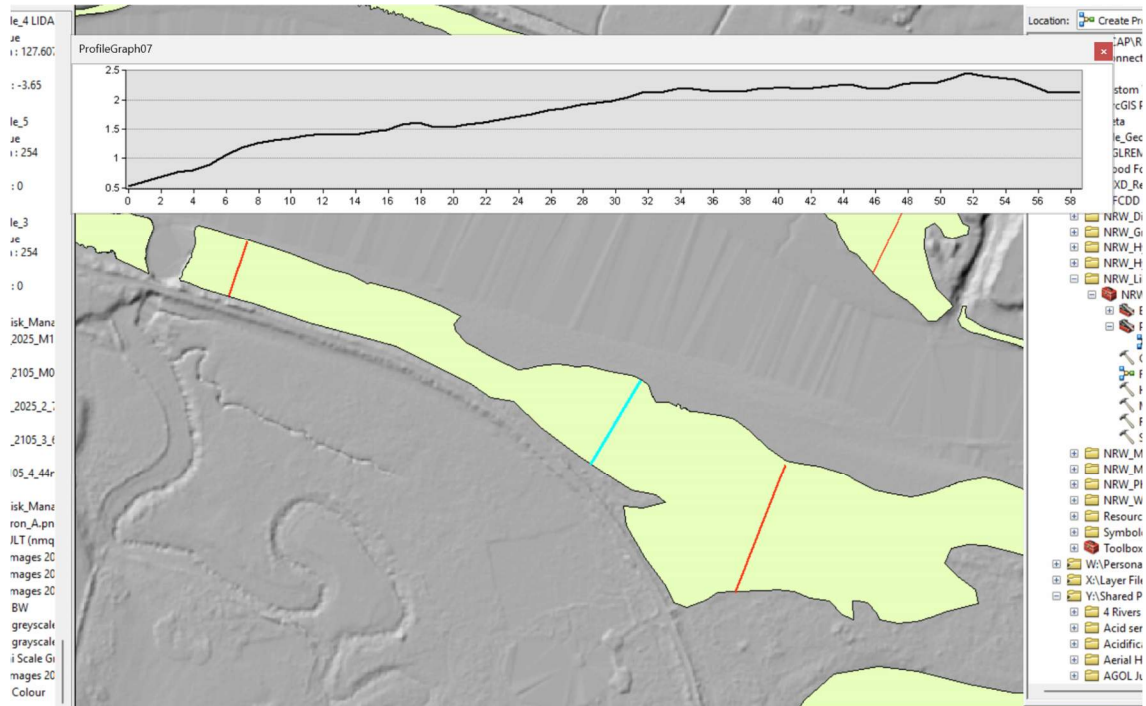
Related gradient for 0-20m seaward slope. Gradient = 0.071 (7.1%)



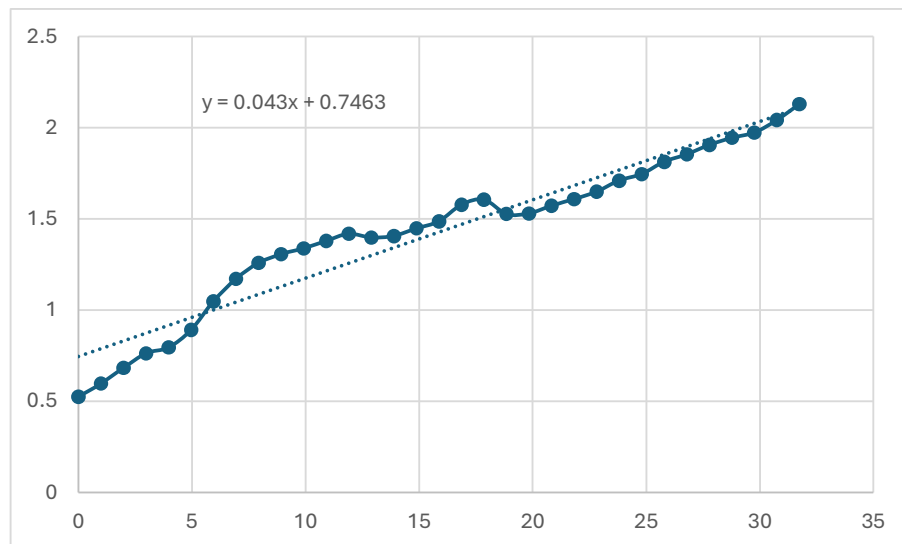
Related gradient for 20-36m seaward slope. Gradient = **0.0209 (2.09%)**



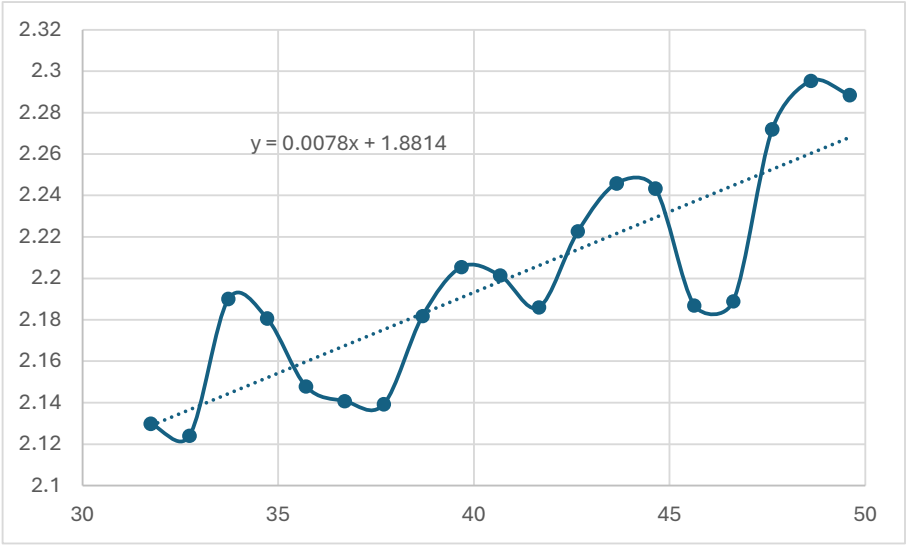
Gradient G



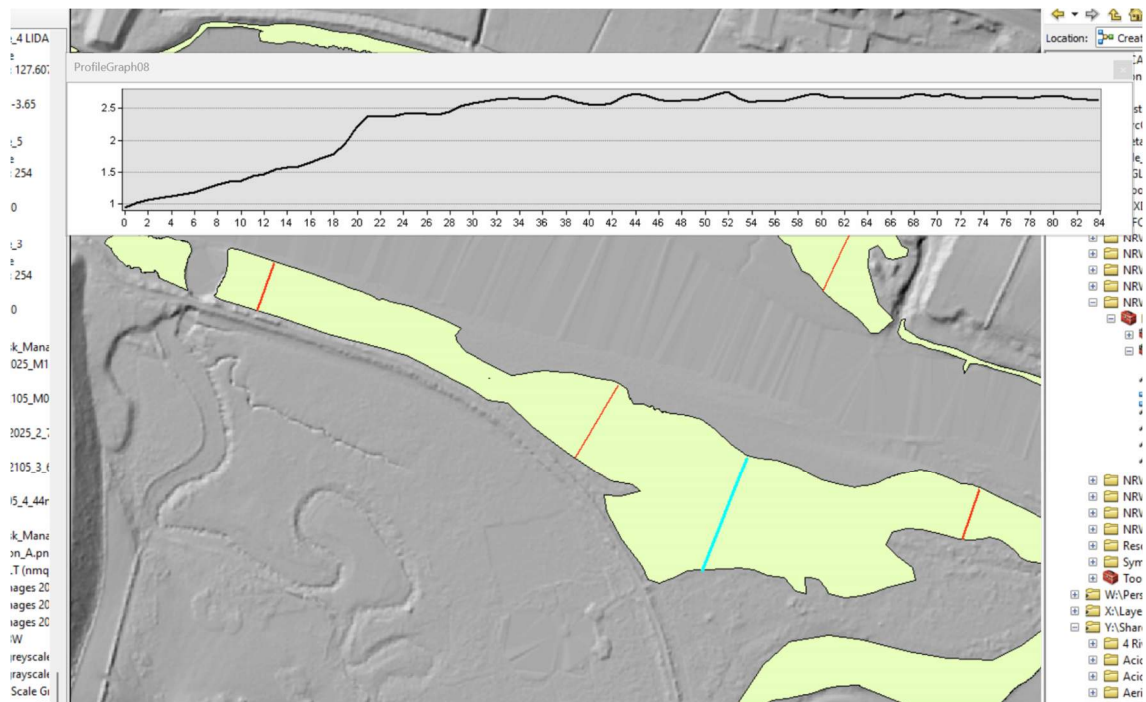
Related gradient for 0-32m seaward slope. Gradient = 0.043 (4.3%)



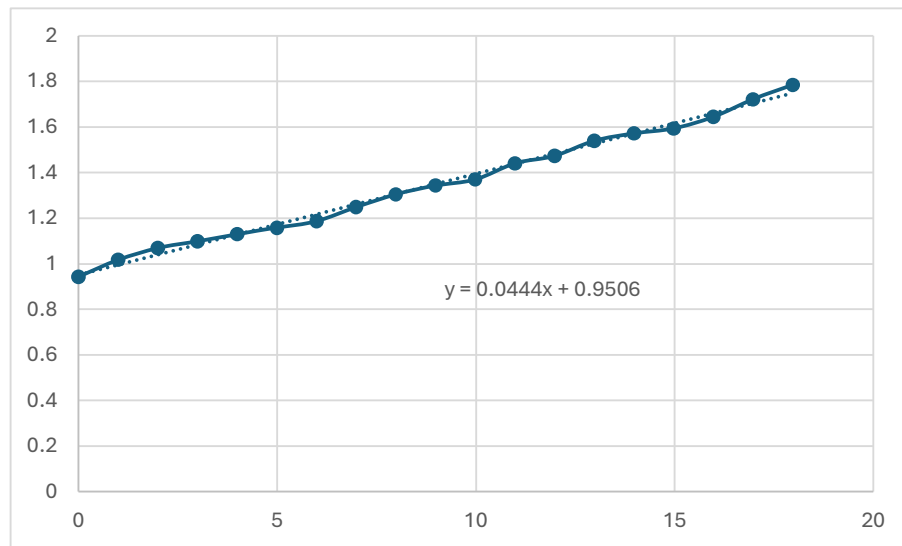
Related gradient for 32-50m seaward slope. Gradient = 0.0078 (0.78%)



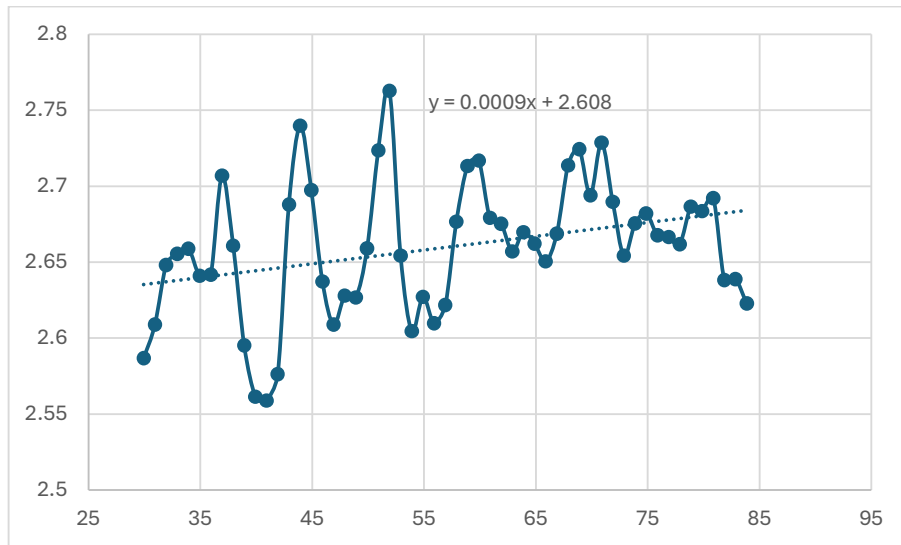
Gradient H



Related gradient for 0-18m seaward slope. Gradient = 0.0444 (4.44%)



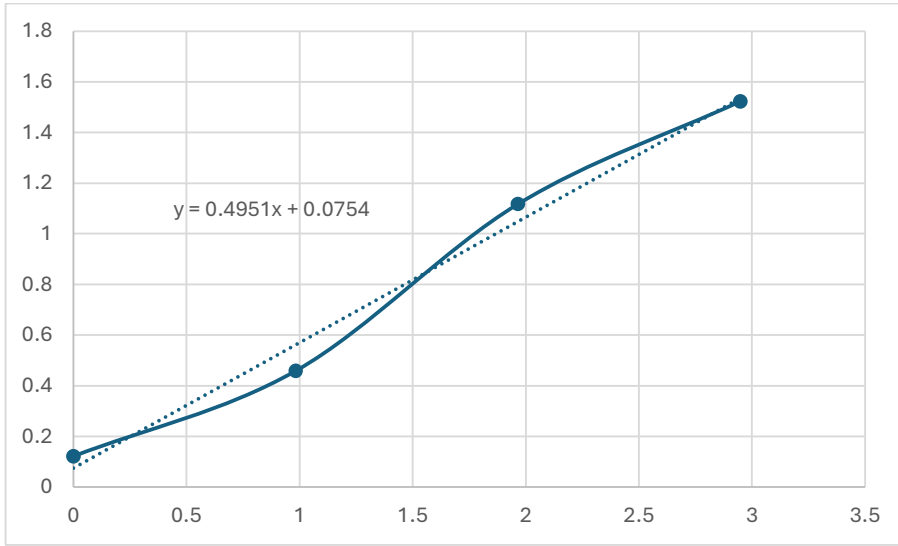
Related gradient for 30-84m seaward slope. Gradient = 0.0009 (0.09%)



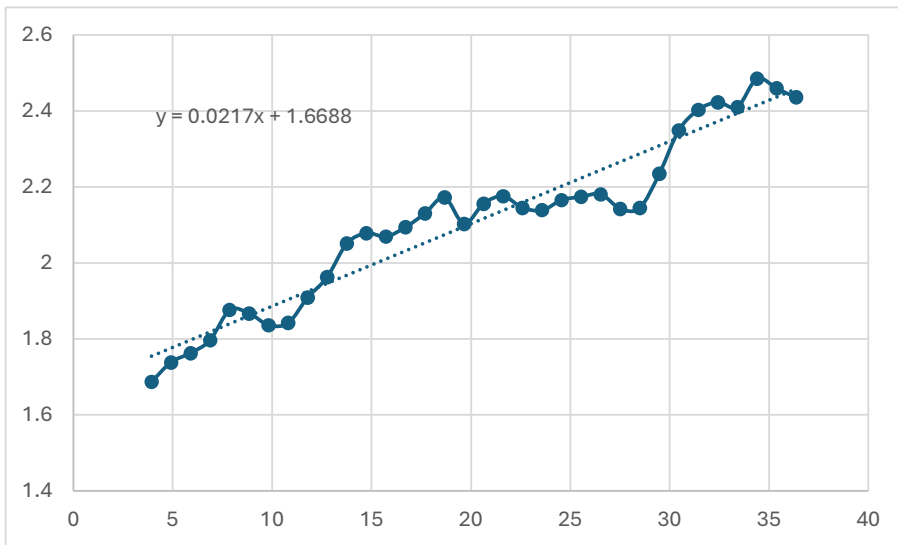
Gradient I



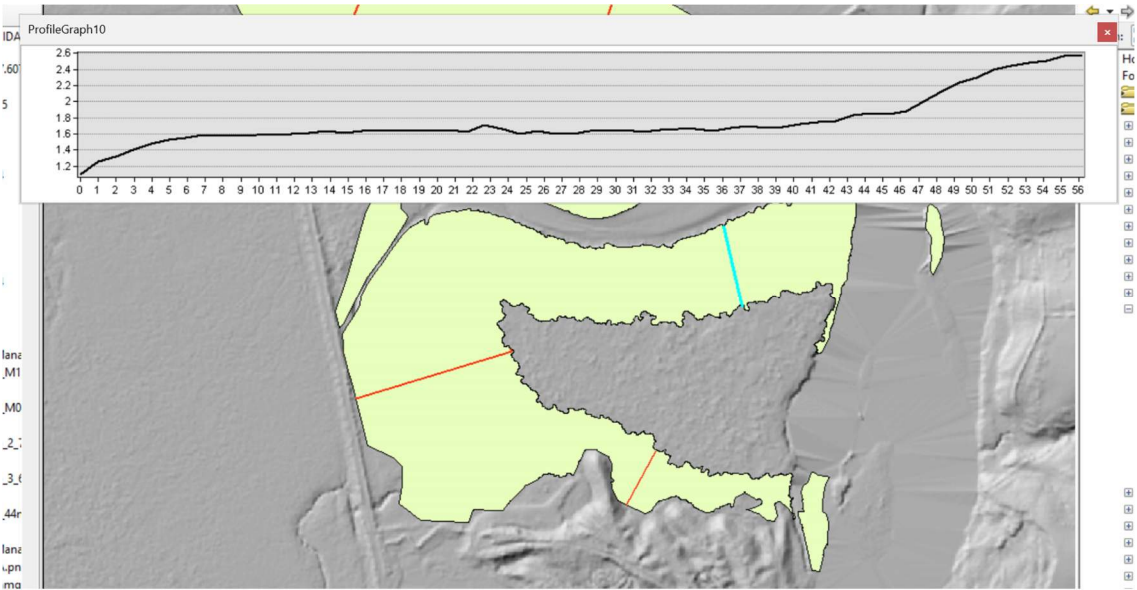
Related gradient for 0-3m seaward slope. Gradient = 0.4951 (49.51%)



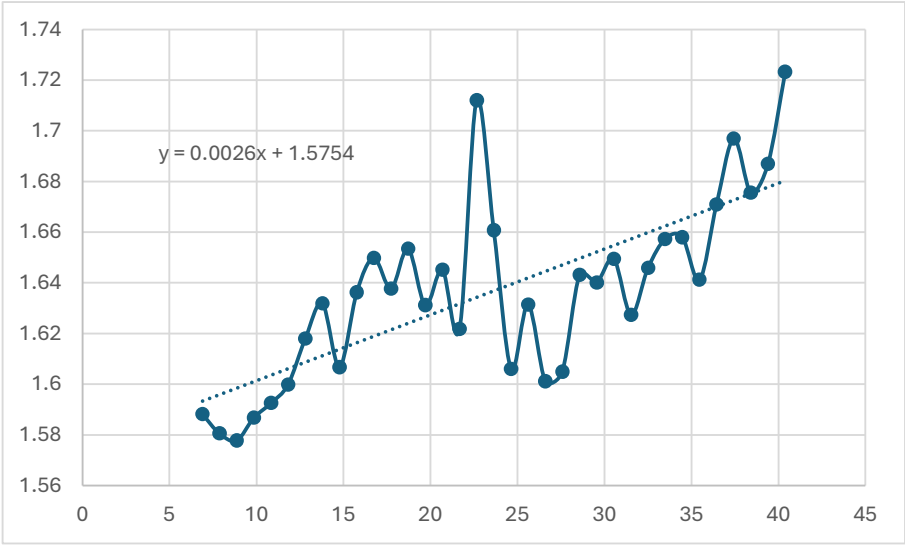
Related gradient for 4-36m seaward slope. Gradient = **0.0217 (2.17%)**



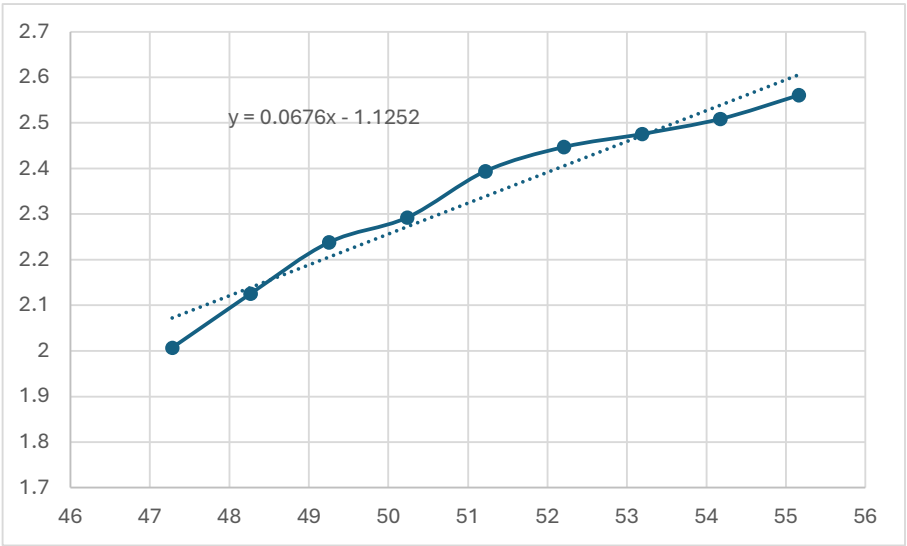
Gradient J



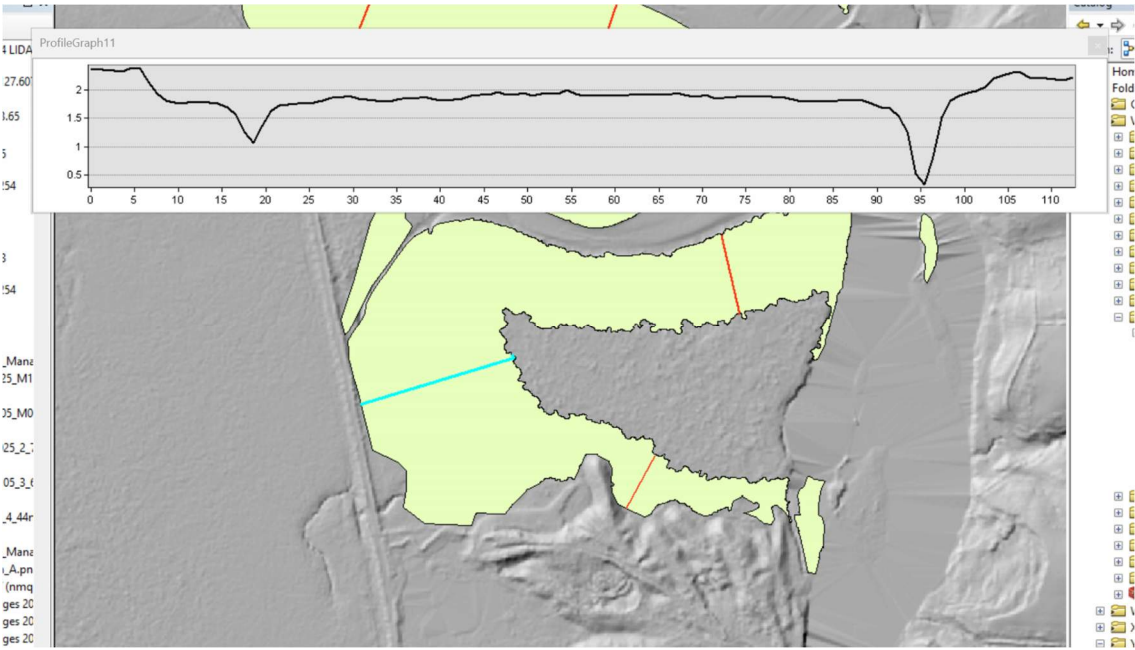
Related gradient for 7-40m seaward slope. Gradient = **0.0026 (0.26%)**



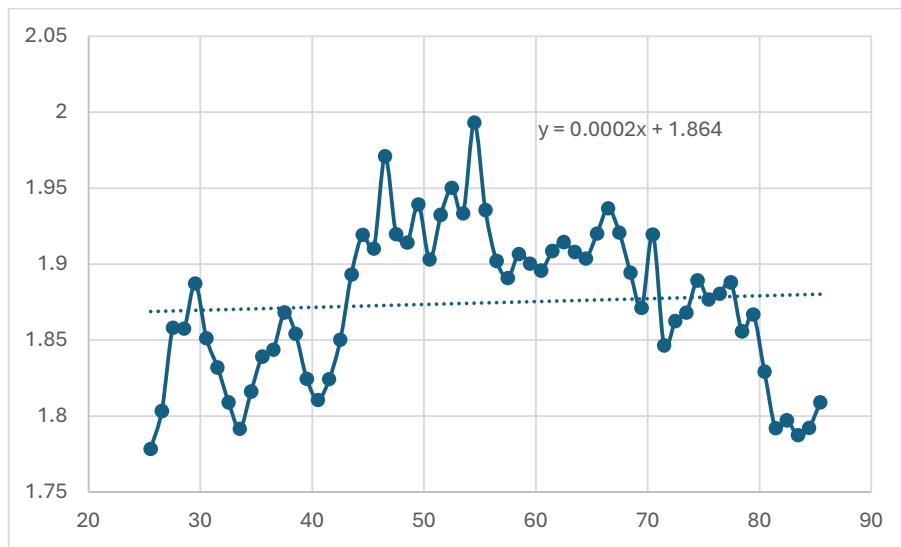
Related gradient for 47-55m seaward slope. Gradient = 0.0676 (6.76%)



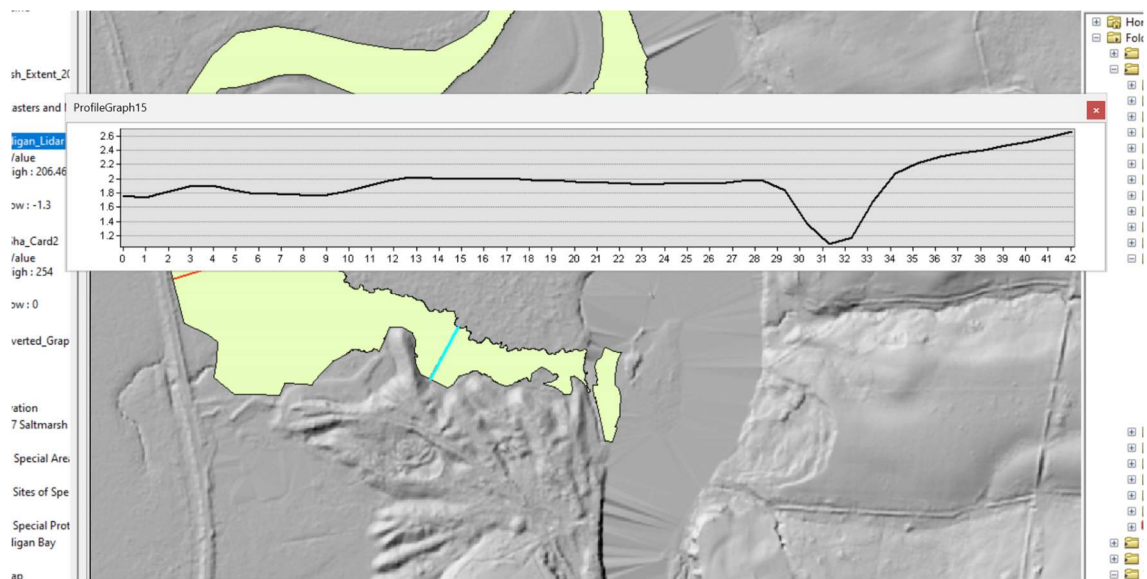
Gradient K



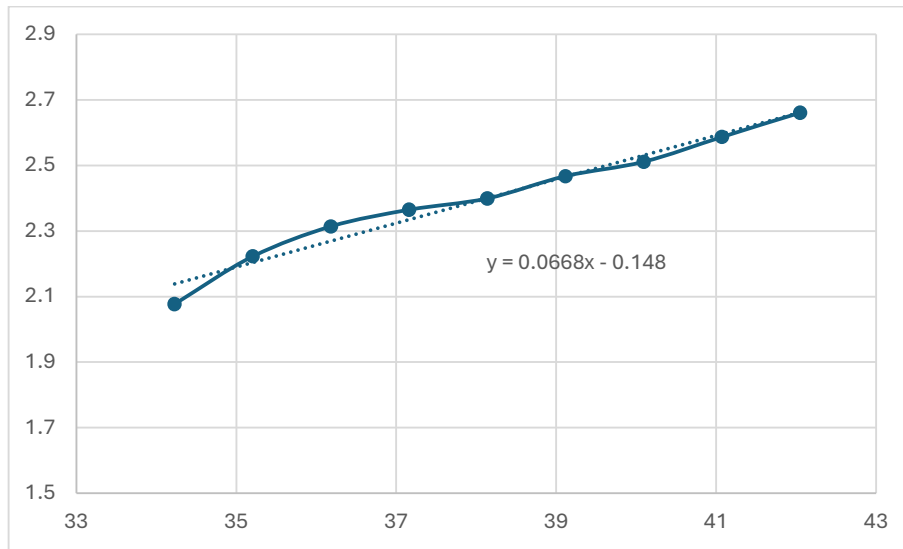
Related gradient for 25-85m seaward slope. Gradient = 0.0002 (0.02%)



Gradient L



Related gradient for 25-85m seaward slope. Gradient = **0.0668 (6.68%)**



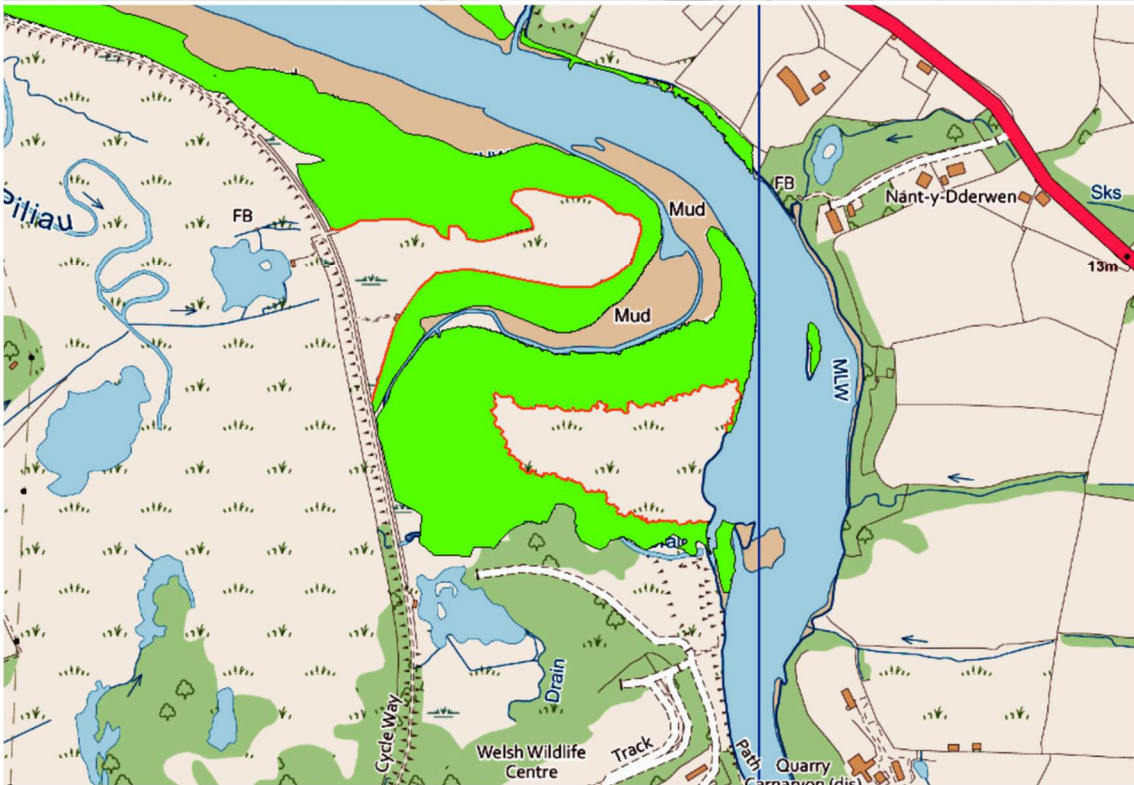
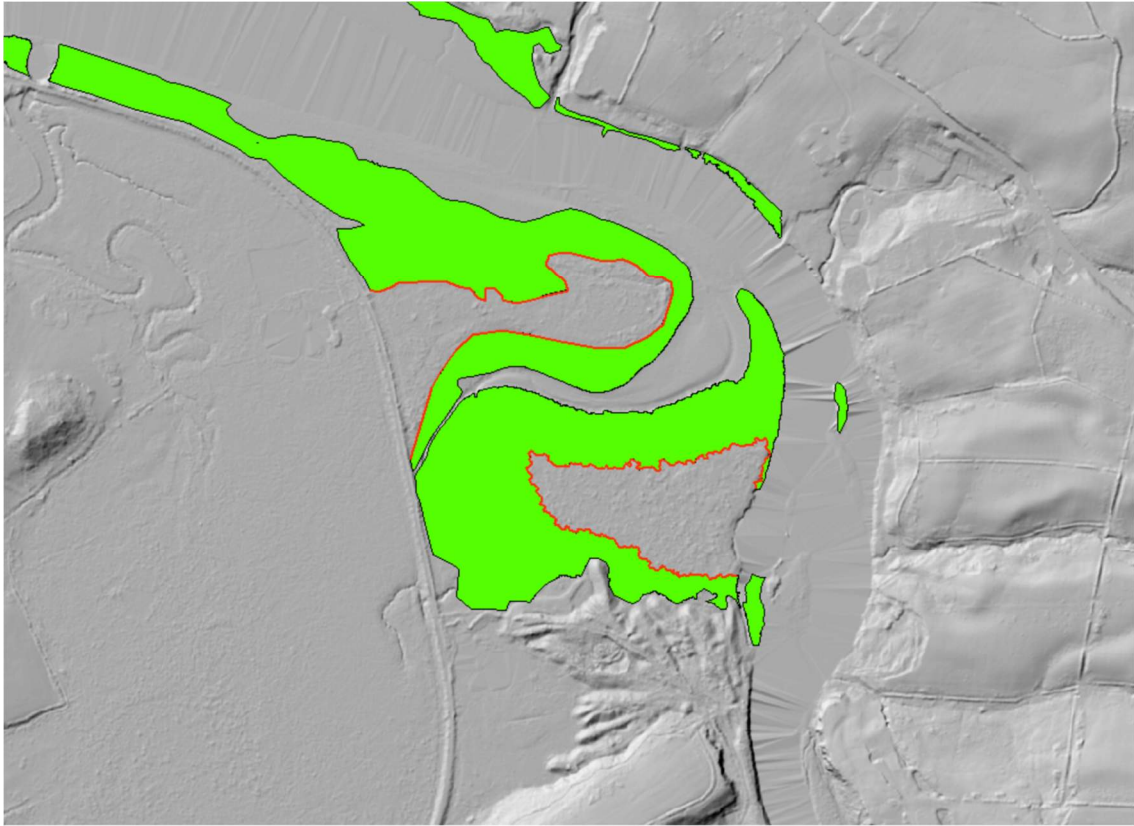
Upper current saltmarsh tidal extent and niche

The most appropriate area for assessing the natural and current upper niche boundary for saltmarsh in Afon Teifi is in the “Welsh Wildlife Centre” Nature Reserve. This area is relatively un-constrained by the effects of coastal squeeze by man-made structures so that the natural upper limits of growth can be assessed.

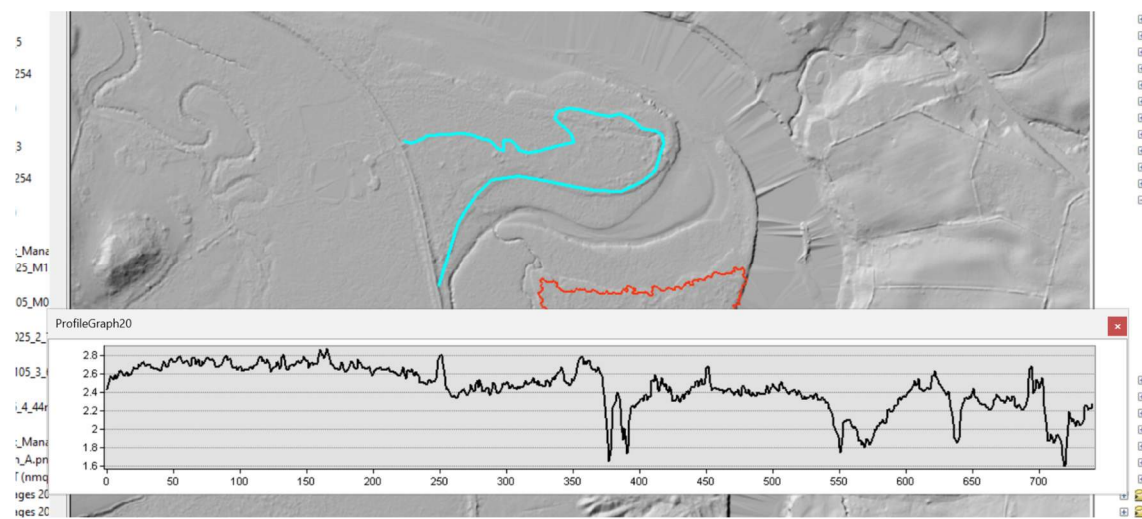
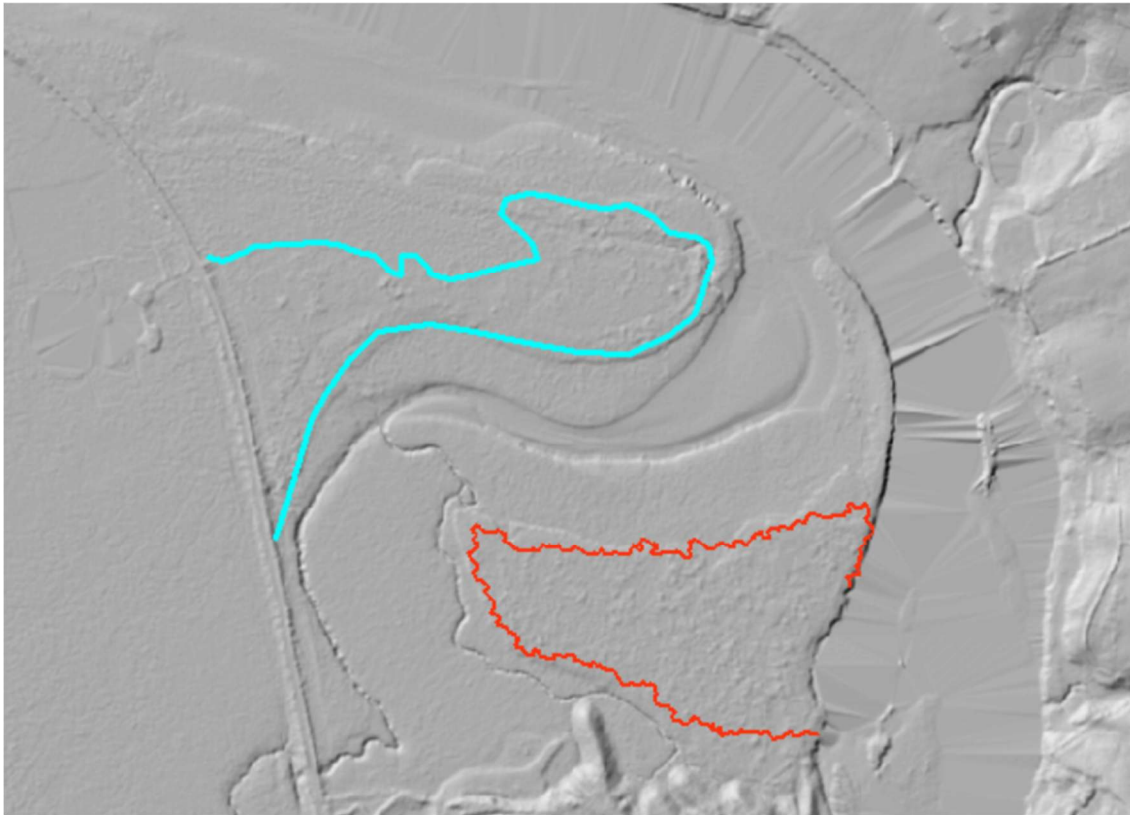
The following assessment identifies the upper range for saltmarsh which reflects the combined levels of tidal levels and river flows suitable for saltmarsh habitat development. No lower niche boundary is identified in this assessment as the lower-limit is likely to be limited by tidal and riverine sediment movement and instability within the channels.

The green areas show the saltmarsh distribution, the digital terrain model illustrates the elevation and structures that may inhibit distribution and squeeze the saltmarsh extent. The red line shows the outline of the areas naturally un-constrained and used in the statistical assessment of upper saltmarsh distribution.

The assessment was undertaken in two zones: zone 1 and zone 2.

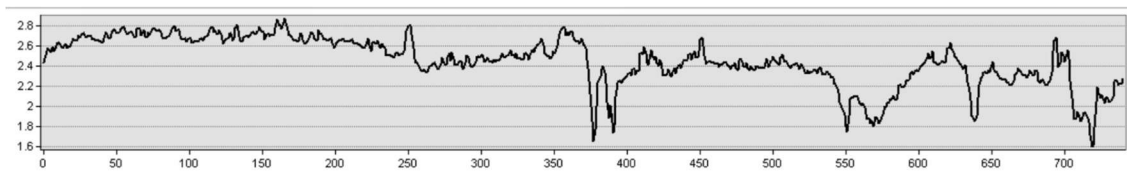


Zone 1

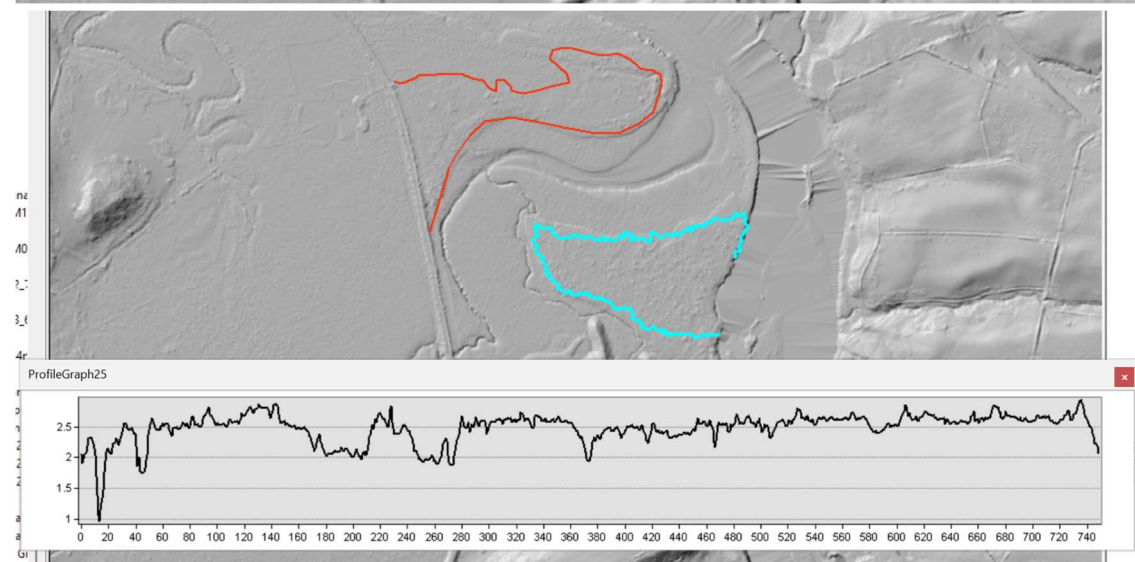


Statistics:

Maximum upper saltmarsh extent in “Zone 1” = 2.87m AOD; the minimum upper extent is 1.6m AOD with average upper saltmarsh extent is 2.45m AOD.

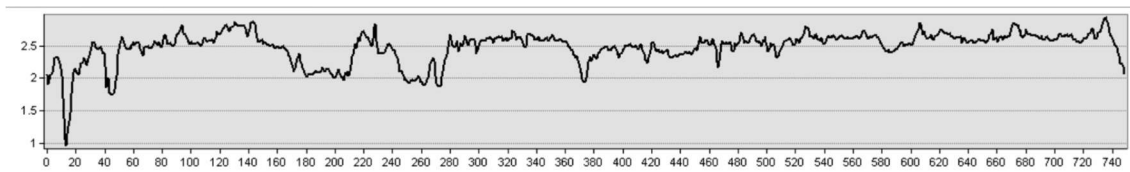


Zone 2



Statistics:

Maximum upper saltmarsh extent in "Zone 2" = 2.97mAOD; the minimum upper extent is 0.96mAOD with average upper saltmarsh extent is 2.48mAOD.



Combining an assessment of these two zones it appears that the upper saltmarsh limit is relatively consistent with an extent of 2.87 to 2.97mAOD as a maximum. Similarly 2.45 to 2.48mAOD is the average upper elevation at which saltmarsh extends.

End